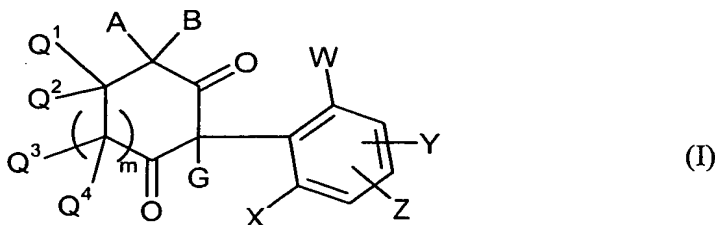


2-Substituted 2-phenyl-1,3-diketones

The invention relates to novel phenyl-substituted cyclopentane- and cyclohexan-1,3-dione derivatives, to processes and intermediates for their preparation and to their use as pesticides, microbicides and/or herbicides.

Cyclic 1,3-diketones which are halogenated in 2-positions and 2-phenyl substituted are known from Thompson, D.J.; J. Organomet. Chem. 108, 381-383, (1976), Kapacchia, H.D., Sunthankar, S.V.; Indian J. Chem., Sect. B, 20 B, 993 (1981). A use as pesticides, microbicides and/or herbicides has not been described.

This invention now provides novel compounds of the formula (I)



in which

W represents cyano, halogen, alkyl, alkenyl, alkynyl, alkoxy, haloalkyl or haloalkoxy,

X represents hydrogen, halogen, alkyl, alkoxy, haloalkyl, haloalkoxy or cyano,

Y represents hydrogen, halogen, alkyl, alkoxy, haloalkyl, haloalkoxy, cyano or optionally substituted phenyl,

Z represents hydrogen, halogen, alkyl, alkoxy, haloalkyl, haloalkoxy or cyano,

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Donna J. Veatch

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G represents halogen or nitro,

m represents the number 0 or 1,

5 A represents hydrogen, in each case optionally halogen-substituted alkyl, alkenyl, alkoxyalkyl, polyalkoxyalkyl, alkylthioalkyl, saturated or unsaturated, optionally substituted cycloalkyl in which optionally at least one ring atom is replaced by a heteroatom, or in each case optionally halogen-, alkyl-, haloalkyl-, alkoxy-, haloalkoxy-, cyano- or nitro-substituted aryl, arylalkyl or  
10 hetaryl,

B represents hydrogen or alkyl,

15 A and B together with the carbon atom to which they are attached represent a saturated or unsaturated, unsubstituted or substituted cycle which optionally contains at least one heteroatom,

20 A and Q<sup>1</sup> together represent optionally substituted alkanediyl in which optionally two not directly adjacent carbon atoms form a further optionally substituted cycle,

Q<sup>1</sup> represents hydrogen, alkyl, alkoxyalkyl, optionally substituted cycloalkyl (in which optionally one methylene group is replaced by oxygen or sulphur) or in each case optionally substituted phenyl, hetaryl, phenylalkyl or hetarylalkyl,

25 Q<sup>2</sup>, Q<sup>3</sup>, Q<sup>4</sup> independently of one another represent hydrogen or alkyl,

Q<sup>1</sup> and Q<sup>2</sup> together with the carbon atom to which they are attached represent a saturated or unsaturated, unsubstituted or substituted cycle which optionally contains a heteroatom.

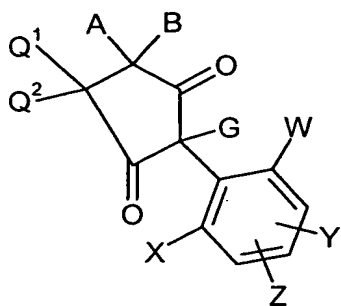
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Depending inter alia on the nature of the substituents, the compounds of the formula (I) can be present as geometrical and/or optical isomers or isomer mixtures of varying composition which, if desired, can be separated in a customary manner. The present invention provides both the pure isomers and the isomer mixtures, their preparation and use and compositions comprising them. However, hereinbelow, for the sake of simplicity, only compounds of the formula (I) are referred to, although what is meant are both the pure compounds and, if appropriate, also mixtures with varying proportions of isomeric compounds.

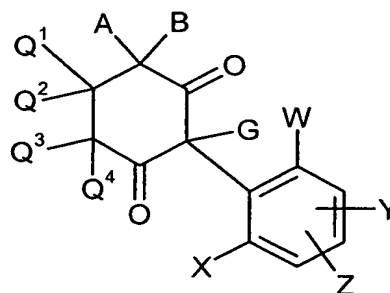
10 The compounds of the formula (I) can be present both as mixtures and in the form of their pure isomers. Mixtures of the compounds of the formula (I) can, if desired, be separated in a manner known per se by physical methods, for example by chromatographic methods.

15 For reasons of clarity, hereinbelow in each case only one of the possible isomers is shown. This does not preclude that the compounds may, if appropriate, be present in the form of the isomer mixtures or the respective other isomeric form.

20 Including the numbers 0 and 1 as meanings of m, the following principle structures (I-1) and (I-2)



(I-1)



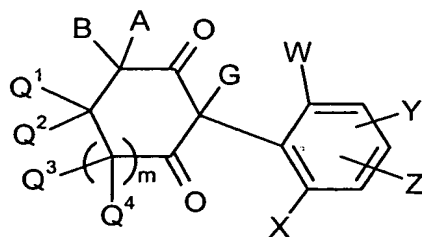
(I-2)

25 result, in which

A, B, G, Q<sup>1</sup>, Q<sup>2</sup>, Q<sup>3</sup>, Q<sup>4</sup>, W, X, Y and Z are as defined above.

A) Furthermore, it has been found

5 that compounds of the formulae (I-1) to (I-2)



m = 0 (I-1)

m = 1 (I-2)

10 in which

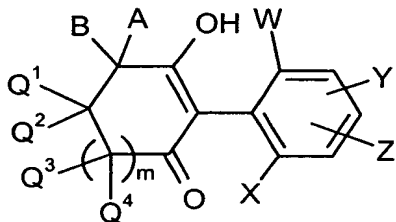
A, B, Q<sup>1</sup>, Q<sup>2</sup>, Q<sup>3</sup>, Q<sup>4</sup>, W, X, Y and Z are as defined above

and

15

G represents halogen, preferably chlorine or bromine,

are obtained when compounds of the formulae (II-1) to (II-2)



m = 0 (II-1)

m = 1 (II-2)

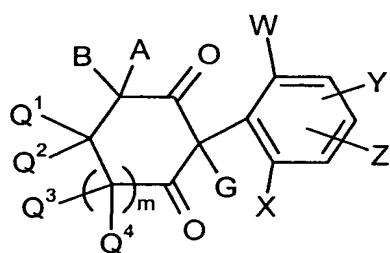
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in which

A, B, Q<sup>1</sup>, Q<sup>2</sup>, Q<sup>3</sup>, Q<sup>4</sup>, W, X, Y and Z are as defined above

are reacted with halogenating agents in the presence of a solvent and, if appropriate, in the presence of a free-radical initiator.

B) Furthermore, compounds of the formulae (I-1) to (I-2)



$m = 0$  (I-1)

$m = 1$  (I-2)

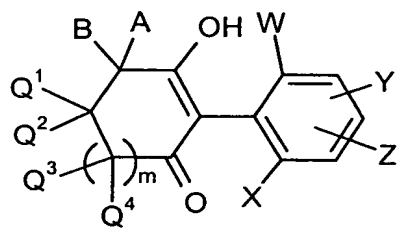
in which

A, B, Q<sup>1</sup>, Q<sup>2</sup>, Q<sup>3</sup>, Q<sup>4</sup>, W, X, Y and Z are as defined above

and

G represents nitro

are obtained when compounds of the formulae (II-1) to (II-2)



$m = 0$  (II-1)

$m = 1$  (II-2)

in which

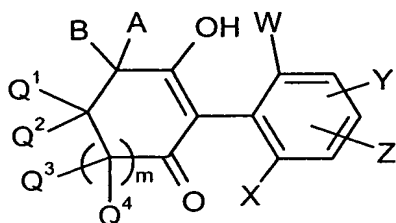
A, B, Q<sup>1</sup>, Q<sup>2</sup>, Q<sup>3</sup>, Q<sup>4</sup>, W, X, Y and Z are as defined above

5

are reacted with nitrating agents, such as, for example, fuming nitric acid, in the presence of a solvent.

Some of the compounds, required for processes A and B, of the formulae II-1 to II-2

10



m = 0 (II-1)

m = 1 (II-2)

in which

15

A, B, Q<sup>1</sup>, Q<sup>2</sup>, Q<sup>3</sup>, Q<sup>4</sup>, W, X, Y and Z are as defined above

20

are known: EP-A-952 149, US-4 283 348; 4 338 122; 4 436 666; 4 526 723; 4 551 547; 4 632 698; WO 96/01 798; WO 96/03 366, WO 97/14 667; WO 98/39281, WO 99/43649, WO 99/48869, WO 99/55673, US-4 175 135, 4 209 432, 4 256 657, 4 256 658, 4 256 659, 4 257 858, 4 303 669, 4 351 666, 4 409 153, 4 613 617, 4 659 372, DE-A 2 813 341, Wheeler, T.N., J. Org. Chem. 44, 4906 (1979), WO 01/09092 and WO 01/74 770, or they can be synthesized by the processes described therein.

25

Halogenating agents suitable for process A are, for example, sulphuryl chloride, sulphuryl bromide, thionyl chloride, thionyl bromide, imides, such as, for example,

N-bromosuccinimide or N-chlorosuccinimide, chlorosulphonic acid, but also hypochlorites, such as, for example, tert-butyl hypochlorite.

5 Nitrating agents suitable for process B are fuming nitric acid and also "nitrating acid mixtures".

Furthermore, it has been found that the novel compounds of the formula (I) are highly active as pesticides, preferably as insecticides, acaricides and/or fungicides and/or herbicides and are additionally tolerated well by plants, in particular by crop plants.

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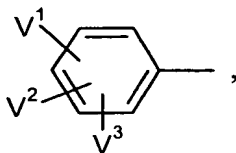
The formula (I) provides a general definition of the compounds according to the invention. Preferred substituents or ranges of the radicals listed in the formulae given above or below are illustrated below:

15 W preferably represents halogen, C<sub>1</sub>-C<sub>6</sub>-alkyl, C<sub>2</sub>-C<sub>6</sub>-alkenyl, C<sub>2</sub>-C<sub>6</sub>-alkynyl, C<sub>1</sub>-C<sub>6</sub>-alkoxy, C<sub>1</sub>-C<sub>4</sub>-haloalkyl, C<sub>1</sub>-C<sub>4</sub>-haloalkoxy or cyano,

X preferably represents hydrogen, halogen, C<sub>1</sub>-C<sub>6</sub>-alkyl, C<sub>1</sub>-C<sub>6</sub>-alkoxy, C<sub>1</sub>-C<sub>4</sub>-haloalkyl, C<sub>1</sub>-C<sub>4</sub>-haloalkoxy or cyano,

20

Y preferably represents hydrogen, halogen, C<sub>1</sub>-C<sub>6</sub>-alkyl, C<sub>1</sub>-C<sub>6</sub>-alkoxy, C<sub>1</sub>-C<sub>4</sub>-haloalkyl, C<sub>1</sub>-C<sub>4</sub>-haloalkoxy, cyano or represents the group



25

V<sup>1</sup> preferably represents hydrogen, halogen, C<sub>1</sub>-C<sub>12</sub>-alkyl, C<sub>1</sub>-C<sub>6</sub>-alkoxy, C<sub>1</sub>-C<sub>6</sub>-alkylthio, C<sub>1</sub>-C<sub>6</sub>-alkylsulphinyl, C<sub>1</sub>-C<sub>6</sub>-alkylsulphonyl, C<sub>1</sub>-C<sub>4</sub>-haloalkyl, C<sub>1</sub>-C<sub>4</sub>-haloalkoxy, nitro, cyano or represents phenyl, phenoxy, phenoxy-C<sub>1</sub>-C<sub>4</sub>-

alkyl, phenyl-C<sub>1</sub>-C<sub>4</sub>-alkoxy, phenylthio-C<sub>1</sub>-C<sub>4</sub>-alkyl or phenyl-C<sub>1</sub>-C<sub>4</sub>-alkylthio, each of which is optionally mono- or polysubstituted by halogen, C<sub>1</sub>-C<sub>6</sub>-alkyl, C<sub>1</sub>-C<sub>6</sub>-alkoxy, C<sub>1</sub>-C<sub>4</sub>-haloalkyl, C<sub>1</sub>-C<sub>4</sub>-haloalkoxy, nitro or cyano,

5

V<sup>2</sup> and V<sup>3</sup> independently of one another preferably represent hydrogen, halogen, C<sub>1</sub>-C<sub>6</sub>-alkyl, C<sub>1</sub>-C<sub>6</sub>-alkoxy, C<sub>1</sub>-C<sub>4</sub>-haloalkyl or C<sub>1</sub>-C<sub>4</sub>-haloalkoxy,

10

V<sup>1</sup> and V<sup>2</sup> together and together with the carbon atoms to which they are attached preferably represent an optionally C<sub>1</sub>-C<sub>4</sub>-alkyl- or halogen-substituted 5- or 6-membered cycle in which optionally one or two carbon atoms may be replaced by oxygen, sulphur or nitrogen,

15

Z preferably represents hydrogen, halogen, C<sub>1</sub>-C<sub>6</sub>-alkyl, C<sub>1</sub>-C<sub>6</sub>-alkoxy, C<sub>1</sub>-C<sub>4</sub>-haloalkyl, C<sub>1</sub>-C<sub>4</sub>-haloalkoxy or cyano,

G preferably represents halogen or nitro,

20

m preferably represents the number 0 or 1,

25

A preferably represents hydrogen or in each case optionally halogen-substituted C<sub>1</sub>-C<sub>12</sub>-alkyl, C<sub>3</sub>-C<sub>8</sub>-alkenyl, C<sub>1</sub>-C<sub>6</sub>-alkoxy-C<sub>1</sub>-C<sub>4</sub>-alkyl, in each case optionally halogen-, C<sub>1</sub>-C<sub>4</sub>-alkyl- or C<sub>1</sub>-C<sub>4</sub>-alkoxy-substituted C<sub>3</sub>-C<sub>8</sub>-cycloalkyl or C<sub>3</sub>-C<sub>6</sub>-cycloalkyl-C<sub>1</sub>-C<sub>4</sub>-alkyl in which optionally one or two not directly adjacent ring members are replaced by oxygen and/or sulphur or represent in each case optionally halogen-, C<sub>1</sub>-C<sub>6</sub>-alkyl-, C<sub>1</sub>-C<sub>6</sub>-haloalkyl-, C<sub>1</sub>-C<sub>6</sub>-alkoxy-, C<sub>1</sub>-C<sub>6</sub>-haloalkoxy-, cyano- or nitro-substituted phenyl, benzyl, hetaryl having 5 or 6 ring atoms (for example, furanyl, pyridyl, imidazolyl, triazolyl, pyrazolyl, pyrimidyl, thiazolyl or thienyl) or hetaryl-C<sub>1</sub>-C<sub>4</sub>-alkyl having 5 or 6 ring atoms (for example, pyridyl, pyrimidyl or thiazolyl),

30



- B preferably represents hydrogen or C<sub>1</sub>-C<sub>6</sub>-alkyl,
- 5 A, B and the carbon atom to which they are attached preferably represent saturated C<sub>3</sub>-C<sub>10</sub>-cycloalkyl or unsaturated C<sub>5</sub>-C<sub>10</sub>-cycloalkyl in which optionally one ring member is replaced by oxygen or sulphur and which are optionally mono- or disubstituted by C<sub>1</sub>-C<sub>6</sub>-alkyl, C<sub>3</sub>-C<sub>8</sub>-cycloalkyl, C<sub>1</sub>-C<sub>6</sub>-haloalkyl, C<sub>1</sub>-C<sub>6</sub>-alkoxy, C<sub>1</sub>-C<sub>6</sub>-alkylthio, halogen or phenyl,
- 10 A and Q<sup>1</sup> together preferably represent C<sub>3</sub>-C<sub>6</sub>-alkanediyl which is optionally mono- or disubstituted by identical or different substituents from the group consisting of C<sub>1</sub>-C<sub>4</sub>-alkyl and C<sub>1</sub>-C<sub>4</sub>-alkoxy,
- 15 Q<sup>1</sup> preferably represents hydrogen, C<sub>1</sub>-C<sub>6</sub>-alkyl, C<sub>1</sub>-C<sub>6</sub>-alkoxy-C<sub>1</sub>-C<sub>2</sub>-alkyl, optionally fluorine-, chlorine-, C<sub>1</sub>-C<sub>4</sub>-alkyl-, C<sub>1</sub>-C<sub>2</sub>-haloalkyl- or C<sub>1</sub>-C<sub>4</sub>-alkoxy-substituted C<sub>3</sub>-C<sub>8</sub>-cycloalkyl in which optionally one methylene group is replaced by oxygen or sulphur or in each case optionally halogen-, C<sub>1</sub>-C<sub>4</sub>-alkyl-, C<sub>1</sub>-C<sub>4</sub>-alkoxy-, C<sub>1</sub>-C<sub>2</sub>-haloalkyl-, C<sub>1</sub>-C<sub>2</sub>-haloalkoxy-, cyano- or nitro-substituted phenyl, pyridyl, thienyl, thiazolyl, phenyl-C<sub>1</sub>-C<sub>4</sub>-alkyl, pyridyl-C<sub>1</sub>-
- 20 C<sub>2</sub>-alkyl or thiazolyl-C<sub>1</sub>-C<sub>2</sub>-alkyl,
- Q<sup>2</sup>, Q<sup>3</sup>, Q<sup>4</sup> independently of one another preferably represent hydrogen or C<sub>1</sub>-C<sub>4</sub>-alkyl,
- 25 Q<sup>1</sup> and Q<sup>2</sup> together with the carbon atom to which they are attached preferably represent optionally C<sub>1</sub>-C<sub>6</sub>-alkyl-, C<sub>1</sub>-C<sub>6</sub>-alkoxy- or C<sub>1</sub>-C<sub>2</sub>-haloalkyl-substituted C<sub>3</sub>-C<sub>7</sub>-cycloalkyl in which optionally one ring member is replaced by oxygen or sulphur.

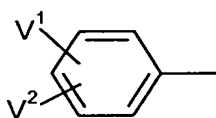
In the radical definitions mentioned as being preferred, halogen, including as a substituent, such as, for example, in haloalkyl, represents fluorine, chlorine, bromine and iodine, in particular fluorine and chlorine.

5 W particularly preferably represents fluorine, chlorine, bromine, C<sub>1</sub>-C<sub>4</sub>-alkyl, C<sub>1</sub>-C<sub>4</sub>-alkoxy, C<sub>1</sub>-C<sub>2</sub>-haloalkyl, C<sub>1</sub>-C<sub>2</sub>-haloalkoxy or cyano,

X particularly preferably represents hydrogen, fluorine, chlorine, bromine, C<sub>1</sub>-C<sub>4</sub>-alkyl or C<sub>1</sub>-C<sub>4</sub>-alkoxy,

10

Y particularly preferably represents hydrogen, fluorine, chlorine, bromine, C<sub>1</sub>-C<sub>6</sub>-alkyl, C<sub>1</sub>-C<sub>6</sub>-alkoxy, C<sub>1</sub>-C<sub>2</sub>-haloalkyl, C<sub>1</sub>-C<sub>2</sub>-haloalkoxy, cyano or represents the group



15

V<sup>1</sup> particularly preferably represents hydrogen, fluorine, chlorine, bromine, C<sub>1</sub>-C<sub>6</sub>-alkyl, C<sub>1</sub>-C<sub>4</sub>-alkoxy, C<sub>1</sub>-C<sub>2</sub>-haloalkyl, C<sub>1</sub>-C<sub>2</sub>-haloalkoxy, nitro, cyano or represents phenyl or phenoxy, each of which is optionally mono- or  
20 disubstituted by fluorine, chlorine, bromine, C<sub>1</sub>-C<sub>4</sub>-alkyl, C<sub>1</sub>-C<sub>4</sub>-alkoxy, C<sub>1</sub>-C<sub>2</sub>-haloalkyl, C<sub>1</sub>-C<sub>2</sub>-haloalkoxy, nitro or cyano,

25

V<sup>2</sup> particularly preferably represents hydrogen, fluorine, chlorine, C<sub>1</sub>-C<sub>4</sub>-alkyl, C<sub>1</sub>-C<sub>4</sub>-alkoxy, C<sub>1</sub>-C<sub>2</sub>-haloalkyl or C<sub>1</sub>-C<sub>2</sub>-haloalkoxy,

V<sup>1</sup> and V<sup>2</sup> together and together with the carbon atoms to which they are attached particularly preferably represent an optionally fluorine- or methyl-substituted 5- or 6-membered cycle in which optionally one or two carbon atoms may be replaced by oxygen,

- Z particularly preferably represents hydrogen, fluorine, chlorine, bromine, C<sub>1</sub>-C<sub>4</sub>-alkyl, C<sub>1</sub>-C<sub>4</sub>-alkoxy, C<sub>1</sub>-C<sub>2</sub>-haloalkyl, C<sub>1</sub>-C<sub>2</sub>-haloalkoxy or cyano,
- 5 G particularly preferably represents chlorine, bromine or nitro,
- m particularly preferably represents the number 0 or 1,
- 10 A particularly preferably represents hydrogen, represents in each case optionally fluorine-substituted C<sub>1</sub>-C<sub>8</sub>-alkyl or C<sub>1</sub>-C<sub>4</sub>-alkoxy-C<sub>1</sub>-C<sub>2</sub>-alkyl, represents in each case optionally fluorine-, chlorine-, methyl-, ethyl- or methoxy-substituted C<sub>5</sub>-C<sub>6</sub>-cycloalkyl or C<sub>3</sub>-C<sub>6</sub>-cycloalkyl-C<sub>1</sub>-C<sub>2</sub>-alkyl in which optionally one ring member is replaced by oxygen or sulphur or in each case optionally fluorine-, chlorine-, bromine-, C<sub>1</sub>-C<sub>4</sub>-alkyl-, C<sub>1</sub>-C<sub>2</sub>-haloalkyl-, C<sub>1</sub>-C<sub>4</sub>-alkoxy- or C<sub>1</sub>-C<sub>2</sub>-haloalkoxy-substituted phenyl or benzyl,
- 15 B particularly preferably represents hydrogen or C<sub>1</sub>-C<sub>4</sub>-alkyl,
- 20 A, B and the carbon atom to which they are attached particularly preferably represent saturated C<sub>5</sub>-C<sub>7</sub>-cycloalkyl in which optionally one ring member is replaced by oxygen and which is optionally monosubstituted by C<sub>1</sub>-C<sub>4</sub>-alkyl, trifluoromethyl or C<sub>1</sub>-C<sub>4</sub>-alkoxy,
- with the proviso that in this case Q<sup>1</sup> only represents hydrogen,
- 25 A and Q<sup>1</sup> together particularly preferably represent C<sub>3</sub>-C<sub>4</sub>-alkanediyl which is optionally mono- or disubstituted by methyl, ethyl, methoxy or ethoxy,
- 30 Q<sup>1</sup> particularly preferably represents hydrogen, C<sub>1</sub>-C<sub>6</sub>-alkyl, C<sub>1</sub>-C<sub>4</sub>-alkoxy-C<sub>1</sub>-C<sub>2</sub>-alkyl or optionally methyl- or methoxy-substituted C<sub>3</sub>-C<sub>6</sub>-cycloalkyl in which optionally one methylene group is replaced by oxygen, or in each case

optionally fluorine-, chlorine-, bromine-, C<sub>1</sub>-C<sub>4</sub>-alkyl-, C<sub>1</sub>-C<sub>4</sub>-alkoxy-, trifluoromethyl- or trifluoromethoxy-substituted phenyl or benzyl,

5 Q<sup>2</sup>, Q<sup>3</sup>, Q<sup>4</sup> independently of one another particularly preferably represent hydrogen, methyl or ethyl,

10 Q<sup>1</sup> and Q<sup>2</sup> together with the carbon to which they are attached particularly preferably represent optionally C<sub>1</sub>-C<sub>4</sub>-alkyl- or C<sub>1</sub>-C<sub>4</sub>-alkoxy-substituted saturated C<sub>5</sub>-C<sub>6</sub>-cycloalkyl in which optionally one ring member is replaced by oxygen,

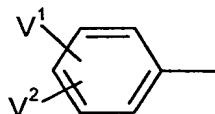
with the proviso that in this case A only represents hydrogen.

15 In the radical definitions mentioned as being particularly preferred, halogen, including as a substituent, such as, for example, in haloalkyl, represents fluorine and chlorine, in particular fluorine.

20 W very particularly preferably represents chlorine, bromine, methyl, ethyl, propyl, methoxy, ethoxy, trifluoromethyl, difluoromethoxy, trifluoromethoxy or cyano,

X very particularly preferably represents hydrogen, chlorine, bromine, methyl, ethyl, propyl, methoxy or ethoxy,

25 Y very particularly preferably represents hydrogen, fluorine, chlorine, bromine, methyl, ethyl, n-propyl, i-butyl, CH(CH<sub>3</sub>)-i-butyl, methoxy, ethoxy, trifluoromethyl, trifluoromethoxy, difluoromethoxy, cyano or represents the group



- 5 V<sup>1</sup> very particularly preferably represents hydrogen, fluorine, chlorine, bromine, methyl, ethyl, n-propyl, isopropyl, n-butyl, isobutyl, tert-butyl, methoxy, ethoxy, n-propoxy, isopropoxy, trifluoromethyl or trifluoromethoxy,
- 10 Z very particularly preferably represents hydrogen, fluorine, chlorine, bromine, methyl, ethyl, propyl, methoxy, ethoxy, trifluoromethyl, trifluoromethoxy, difluoromethoxy or cyano,
- 15 G very particularly preferably represents chlorine, bromine or nitro (especially chlorine),
- m very particularly preferably represents the number 0 or 1,
- 20 A very particularly preferably represents hydrogen, methyl, ethyl, n-propyl, isopropyl, n-butyl, isobutyl, methoxymethyl or ethoxymethyl,
- 25 B very particularly preferably represents hydrogen, methyl or ethyl,
- A, B and the carbon atom to which they are attached very particularly preferably represent saturated C<sub>5</sub>-C<sub>7</sub>-cycloalkyl in which optionally one ring member is replaced by oxygen and which is optionally monosubstituted by methyl, ethyl, isopropyl, trifluoromethyl, methoxy, ethoxy, n-propoxy, n-butoxy or isobutoxy,
- 30 with the proviso that in this case Q<sup>1</sup>, Q<sup>2</sup>, Q<sup>3</sup> and Q<sup>4</sup> only represent hydrogen,
- A and Q<sup>1</sup> together very particularly preferably represent C<sub>3</sub>-C<sub>4</sub>-alkanediyl,

- Q<sup>1</sup> very particularly preferably represents hydrogen, methyl, ethyl, n-propyl, isopropyl, n-hexyl, cyclopropyl, cyclopentyl or cyclohexyl,
- 5 Q<sup>2</sup>, Q<sup>3</sup>, Q<sup>4</sup> independently of one another very particularly preferably represent hydrogen, methyl or ethyl,
- Q<sup>1</sup> and Q<sup>2</sup> together with the carbon to which they are attached very particularly preferably represent optionally methyl-, ethyl-, methoxy-, ethoxy-, n-propoxy- or n-butoxy-substituted saturated C<sub>5</sub>-C<sub>6</sub>-cycloalkyl in which optionally one  
10 ring member is replaced by oxygen,
- with the proviso that in this case A, B, Q<sup>3</sup> and Q<sup>4</sup> only represent hydrogen.
- 15 W especially preferably represents methyl or chlorine,
- X especially preferably represents hydrogen or methyl,
- Y especially preferably represents phenyl which is optionally mono- or  
20 disubstituted by fluorine or chlorine, represents chlorine, bromine, methyl, ethyl, n-propyl, i-butyl, CH(CH<sub>3</sub>)-i-butyl or trifluoromethyl,
- Z especially preferably represents hydrogen,
- 25 G especially preferably represents chlorine,
- m especially preferably represents 0 or 1,
- A especially preferably represents hydrogen or methyl,
- 30 B especially preferably represents hydrogen or methyl,

A, B and the carbon atom to which they are attached especially preferably represent C<sub>5</sub>-C<sub>7</sub>-cycloalkyl, with the proviso that in this case Q<sup>1</sup> and Q<sup>2</sup> only represent hydrogen,

5

Q<sup>1</sup> especially preferably represents hydrogen, methyl, ethyl, i-propyl or n-hexyl,

Q<sup>2</sup> especially preferably represents hydrogen or methyl,

10

Q<sup>1</sup>, Q<sup>2</sup> and the carbon atom to which they are attached especially preferably represent C<sub>5</sub>-C<sub>6</sub>-cycloalkyl, with the proviso that in this case A and B only represent hydrogen,

Q<sup>3</sup> especially preferably represents hydrogen,

15

Q<sup>4</sup> especially preferably represents hydrogen.

In the case of the compounds of the formula (I-2), A and B represent in particular hydrogen.

20

The general or preferred radical definitions or illustrations given above can be combined with one another as desired, i.e. including combinations between the respective ranges and preferred ranges. The definitions apply both to the end products and, correspondingly, to precursors and intermediates.

25

Preference according to the invention is given to the compounds of the formula (I) which contain a combination of the meanings listed above as being preferred (preferable).

Particular preference according to the invention is given to the compounds of the formula (I) which contain a combination of the meanings listed above as being particularly preferred.

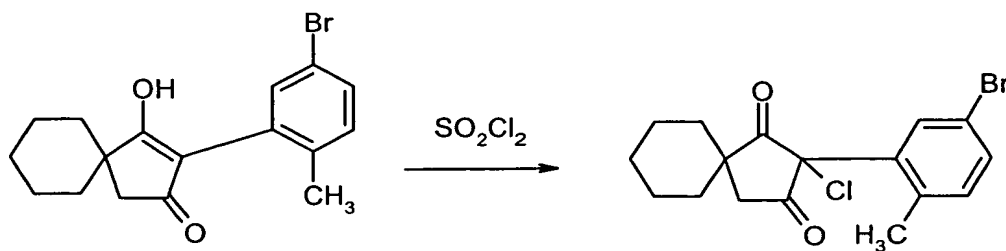
5 Very particular preference according to the invention is given to the compounds of the formula (I) which contain a combination of the meanings listed above as being very particularly preferred.

10 Special preference according to the invention is given to the compounds of the formula (I) which contain a combination of the meanings listed above as being especially preferred.

15 Saturated or unsaturated hydrocarbon radicals, such as alkyl or alkenyl, can in each case be straight-chain or branched as far as possible, also in combination with heteroatoms, such as, for example, in alkoxy.

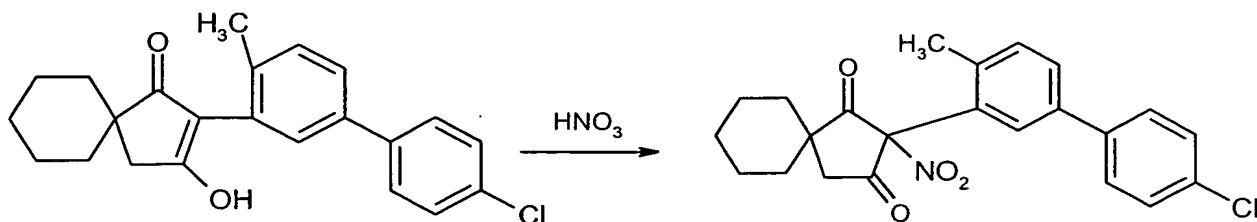
Using, for example, according to process (A) 2-(2-methyl-5-bromo)phenyl-4,4-pentamethylenecyclopentane-1,3-dione or its enol as starting material, the course of the process according to the invention can be represented by the reaction scheme below:

20



25 Using, for example, according to process (B) 2-[2-methyl-5-(4-chlorophenyl)phenyl]-4,4-pentamethylenecyclopentane-1,3-dione or its enol, the course of the process according to the invention can be represented by the reaction scheme below:





The process (A) is characterized in that compounds of the formula (II) in which A, B, Q<sup>1</sup>, Q<sup>2</sup>, Q<sup>3</sup>, Q<sup>4</sup>, W, X, Y, Z and m are as defined above, are reacted in the presence of a diluent and a halogenating agent and, if appropriate, a free-radical initiator. Suitable for use as free-radical initiators are, for example, benzoyl peroxide or azobisisobutyronitrile.

Suitable for use as diluents in the process (A) according to the invention are all inert organic solvents. Preference is given to using hydrocarbons, such as benzene, toluene and xylene, furthermore ethers, such as dibutyl ether, tetrahydrofuran, dioxane, glycol dimethyl ether and diglycol dimethyl ether, moreover halogenated hydrocarbons, such as dichloromethane, chloroform, carbon tetrachloride, dichloroethane, chlorobenzene, dichlorobenzene, but also esters, such as ethyl acetate.

Suitable halogenating agents for process A are, for example, sulphuryl chloride, sulphuryl bromide, thionyl chloride, thionyl bromide, imides, such as, for example, N-bromosuccinimide, N-chlorosuccinimide, furthermore chlorosulphonic acid, but also hypochlorites, such as, for example, tert-butyl hypochlorite.

When carrying out the process (A) according to the invention, the reaction temperatures can be varied within a relatively wide range. In general, the process is carried out at temperatures between -40°C and 150°C, preferably between 0°C and 100°C.

The process (A) according to the invention is generally carried out under atmospheric pressure.

When carrying out the process (A) according to the invention, the reaction components of the formula (II) and the halogenating agents are generally employed in approximately equimolar amounts. However, it is also possible to use a relatively large excess (up to 3 mol) of one component or the other.

5

Purification is generally carried out after aqueous work-up, by crystallization or by chromatographic purification on silica gel.

10

The process (B) is characterized in that compounds of the formula (II) in which A, B, Q<sup>1</sup>, Q<sup>2</sup>, Q<sup>3</sup>, Q<sup>4</sup>, W, X, Y, Z and m are as defined above are reacted in the presence of a diluent and in the presence of a nitrating agent.

15

Diluents suitable for use in the process (B) according to the invention are all inert organic solvents. Preference is given to using halogenated hydrocarbons, such as methylene chloride, chloroform, dichlorobenzene, dichloroethane.

Suitable nitrating agents are nitrating acids, preferably fuming nitric acid.

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When carrying out the process (B) according to the invention, the reaction temperatures can be varied within a relatively wide range. In general, the process is carried out at temperatures between -50°C and 150°C, preferably between 0°C and 80°C.

25

The process (B) according to the invention is generally carried out under atmospheric pressure.

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When carrying out the process (B) according to the invention, the reaction components of the formula (II) and the nitrating agent are generally employed in approximately equimolar amounts. However, it is also possible to use a relatively large excess (up to 5 mol) of one component or the other.

Purification is carried out after customary work-up by crystallization or by chromatographic purification on silica gel.

5 The active compounds are suitable for protecting plants and plant organs, for increasing the harvest yields, for improving the quality of the harvested goods and for controlling animal pests, in particular insects, arachnids and nematodes, which are encountered in agriculture, in forests, in gardens and leisure facilities, in the protection of stored products and of materials, and in the hygiene sector, and have good plant tolerance, favourable toxicity to warm-blooded animals and good  
10 environmental compatibility. They may preferably be employed as crop protection agents. They are active against normally sensitive and resistant species and against all or some stages of development. The abovementioned pests include:

15 From the order of the Isopoda, for example, *Oniscus asellus*, *Armadillidium vulgare* and *Porcellio scaber*.

From the order of the Diplopoda, for example, *Blaniulus guttulatus*.

20 From the order of the Chilopoda, for example, *Geophilus carpophagus* and *Scutigera* spp.

From the order of the Symphyla, for example, *Scutigera* *immaculata*.

25 From the order of the Thysanura, for example, *Lepisma saccharina*.

From the order of the Collembola, for example, *Onychiurus armatus*.

30 From the order of the Orthoptera, for example, *Acheta domesticus*, *Gryllotalpa* spp., *Locusta migratoria migratorioides*, *Melanoplus* spp. and *Schistocerca gregaria*.

From the order of the Blattaria, for example, *Blatta orientalis*, *Periplaneta americana*, *Leucophaea maderae*, *Blattella germanica*.

From the order of the Dermaptera, for example, *Forficula auricularia*.

5

From the order of the Isoptera, for example, *Reticulitermes* spp.

From the order of the Phthiraptera, for example, *Pediculus humanus corporis*, *Haematopinus* spp., *Linognathus* spp., *Trichodectes* spp. and *Damalinia* spp.

10

From the order of the Thysanoptera, for example, *Hercinothrips femoralis*, *Thrips tabaci*, *Thrips palmi* and *Frankliniella accidentalis*.

From the order of the Heteroptera, for example, *Eurygaster* spp., *Dysdercus intermedius*, *Piesma quadrata*, *Cimex lectularius*, *Rhodnius prolixus* and *Triatoma* spp.

15

From the order of the Homoptera, for example, *Aleurodes brassicae*, *Bemisia tabaci*, *Trialeurodes vaporariorum*, *Aphis gossypii*, *Brevicoryne brassicae*, *Cryptomyzus ribis*, *Aphis fabae*, *Aphis pomi*, *Eriosoma lanigerum*, *Hyalopterus arundinis*, *Phylloxera vastatrix*, *Pemphigus* spp., *Macrosiphum avenae*, *Myzus* spp., *Phorodon humuli*, *Rhopalosiphum padi*, *Empoasca* spp., *Euscelis bilobatus*, *Nephotettix cincticeps*, *Lecanium corni*, *Saissetia oleae*, *Laodelphax striatellus*, *Nilaparvata lugens*, *Aonidiella aurantii*, *Aspidiotus hederae*, *Pseudococcus* spp. and *Psylla* spp.

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From the order of the Lepidoptera, for example, *Pectinophora gossypiella*, *Bupalus piniarius*, *Cheimatobia brumata*, *Lithocolletis blancardella*, *Hyponomeuta padella*, *Plutella xylostella*, *Malacosoma neustria*, *Euproctis chrysorrhoea*, *Lymantria* spp., *Bucculatrix thurberiella*, *Phyllocnistis citrella*, *Agrotis* spp., *Euxoa* spp., *Feltia* spp., *Earias insulana*, *Heliothis* spp., *Mamestra brassicae*, *Panolis flammea*, *Spodoptera* spp., *Trichoplusia ni*, *Carpocapsa pomonella*, *Pieris* spp., *Chilo* spp., *Pyrausta*

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nubilalis, Ephestia kuehniella, Galleria mellonella, Tineola bisselliella, Tinea pellionella, Hofmannophila pseudospretella, Cacoecia podana, Capua reticulana, Choristoneura fumiferana, Clysia ambiguella, Homona magnanima, Tortrix viridana, Cnaphalocerus spp., Oulema oryzae.

5

From the order of the Coleoptera, for example, Anobium punctatum, Rhizopertha dominica, Bruchidius obtectus, Acanthoscelides obtectus, Hylotrupes bajulus, Agelastica alni, Leptinotarsa decemlineata, Phaedon cochleariae, Diabrotica spp., Psylliodes chrysocephala, Epilachna varivestis, Atomaria spp., Oryzaephilus surinamensis, Anthonomus spp., Sitophilus spp., Otiorrhynchus sulcatus, Cosmopolites sordidus, Ceuthorrhynchus assimilis, Hypera postica, Dermestes spp., Trogoderma spp., Anthrenus spp., Attagenus spp., Lyctus spp., Meligethes aeneus, Ptinus spp., Niptus hololeucus, Gibbium psylloides, Tribolium spp., Tenebrio molitor, Agriotes spp., Conoderus spp., Melolontha melolontha, Amphimallon solstitialis, Costelytra zealandica and Lissorhoptrus oryzophilus.

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From the order of the Hymenoptera, for example, Diprion spp., Hoplocampa spp., Lasius spp., Monomorium pharaonis and Vespa spp.

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From the order of the Diptera, for example, Aedes spp., Anopheles spp., Culex spp., Drosophila melanogaster, Musca spp., Fannia spp., Calliphora erythrocephala, Lucilia spp., Chrysomya spp., Cuterebra spp., Gastrophilus spp., Hyppobosca spp., Stomoxys spp., Oestrus spp., Hypoderma spp., Tabanus spp., Tannia spp., Bibio hortulanus, Oscinella frit, Phorbia spp., Pegomyia hyoscyami, Ceratitis capitata, Dacus oleae, Tipula paludosa, Hylemyia spp. and Liriomyza spp.

25

From the order of the Siphonaptera, for example, Xenopsylla cheopis and Ceratophyllus spp.

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From the class of the Arachnida, for example, Scorpio maurus, Latrodectus mactans, Acarus siro, Argas spp., Ornithodoros spp., Dermanyssus gallinae, Eriophyes ribis,

Phyllocoptura oleivora, Boophilus spp., Rhipicephalus spp., Amblyomma spp., Hyalomma spp., Ixodes spp., Psoroptes spp., Chorioptes spp., Sarcoptes spp., Tarsonemus spp., Bryobia praetiosa, Panonychus spp., Tetranychus spp., Hemitarsonemus spp., Brevipalpus spp.

5

The phytoparasitic nematodes include, for example, Pratylenchus spp., Radopholus similis, Ditylenchus dipsaci, Tylenchulus semipenetrans, Heterodera spp., Globodera spp., Meloidogyne spp., Aphelenchoides spp., Longidorus spp., Xiphinema spp., Trichodorus spp., Bursaphelenchus spp.

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If appropriate, the compounds according to the invention can, at certain concentrations or application rates, also be used as herbicides or microbicides, for example as fungicides, antimycotics and bactericides. If appropriate, they can also be employed as intermediates or precursors for the synthesis of other active compounds.

15

All plants and plant parts can be treated in accordance with the invention. Plants are to be understood as meaning in the present context all plants and plant populations such as desired and undesired wild plants or crop plants (including naturally occurring crop plants). Crop plants can be plants which can be obtained by conventional plant breeding and optimization methods or by biotechnological and recombinant methods or by combinations of these methods, including the transgenic plants and inclusive of the plant cultivars protectable or not protectable by plant breeders' rights. Plant parts are to be understood as meaning all parts and organs of plants above and below the ground, such as shoot, leaf, flower and root, examples which may be mentioned being leaves, needles, stalks, stems, flowers, fruit bodies, fruits, seeds, roots, tubers and rhizomes. The plant parts also include harvested material, and vegetative and generative propagation material, for example cuttings, tubers, rhizomes, offsets and seeds.

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Treatment according to the invention of the plants and plant parts with the active compounds is carried out directly or by allowing the compounds to act on their

surroundings, environment or storage space by the customary treatment methods, for example by immersion, spraying, evaporation, fogging, scattering, painting on, injecting and, in the case of propagation material, in particular in the case of seeds, also by applying one or more coats.

5

The active compounds can be converted to the customary formulations, such as solutions, emulsions, wettable powders, suspensions, powders, dusts, pastes, soluble powders, granules, suspension-emulsion concentrates, natural and synthetic materials impregnated with active compound and microencapsulations in polymeric substances.

10

These formulations are produced in a known manner, for example by mixing the active compounds with extenders, that is, liquid solvents, and/or solid carriers, optionally with the use of surfactants, that is emulsifiers and/or dispersants, and/or foam-formers.

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If the extender used is water, it is also possible to employ for example organic solvents as auxiliary solvents. Essentially, suitable liquid solvents are: aromatics such as xylene, toluene or alkylnaphthalenes, chlorinated aromatics or chlorinated aliphatic hydrocarbons such as chlorobenzenes, chloroethylenes or methylene chloride, aliphatic hydrocarbons such as cyclohexane or paraffins, for example petroleum fractions, mineral and vegetable oils, alcohols such as butanol or glycol and also their ethers and esters, ketones such as acetone, methyl ethyl ketone, methyl isobutyl ketone or cyclohexanone, strongly polar solvents such as dimethylformamide and dimethyl sulphoxide, and also water.

20

25

Suitable solid carriers are:

for example ammonium salts and ground natural minerals such as kaolins, clays, talc, chalk, quartz, attapulgite, montmorillonite or diatomaceous earth, and ground synthetic minerals, such as highly disperse silica, alumina and silicates; suitable solid

30

carriers for granules are: for example crushed and fractionated natural rocks such as calcite, marble, pumice, sepiolite and dolomite, and also synthetic granules of inorganic and organic meals, and granules of organic material such as sawdust, coconut shells, maize cobs and tobacco stalks; suitable emulsifiers and/or foam-formers are: for example nonionic and anionic emulsifiers, such as polyoxyethylene fatty acid esters, polyoxyethylene fatty alcohol ethers, for example alkylaryl polyglycol ethers, alkylsulphonates, alkyl sulphates, arylsulphonates and also protein hydrolysates; suitable dispersants are: for example lignin-sulphite waste liquors and methylcellulose.

Tackifiers such as carboxymethylcellulose and natural and synthetic polymers in the form of powders, granules or latices, such as gum arabic, polyvinyl alcohol and polyvinyl acetate, as well as natural phospholipids such as cephalins and lecithins, and synthetic phospholipids, can be used in the formulations. Other possible additives are mineral and vegetable oils.

It is possible to use colorants such as inorganic pigments, for example iron oxide, titanium oxide and Prussian Blue, and organic dyestuffs, such as alizarin dyestuffs, azo dyestuffs and metal phthalocyanine dyestuffs, and trace nutrients such as salts of iron, manganese, boron, copper, cobalt, molybdenum and zinc.

The formulations generally comprise between 0.1 and 95% by weight of active compound, preferably between 0.5 and 90%.

The active compounds according to the invention can be employed as such or in their formulations as a mixture with known fungicides, bactericides, acaricides, nematocides or insecticides in order, for example, to increase the activity spectrum or avoid the development of resistance. In many cases synergistic effects are achieved, i.e. the efficacy of the mixture is greater than the efficacy of the individual components.



Suitable co-components in mixtures are, for example, the following compounds:

**Fungicides:**

- 5      aldimorph, ampropylfos, ampropylfos-potassium, andoprim, anilazine, azaconazole, azoxystrobin,
- 10      benalaxyl, benodanil, benomyl, benzamacril, benzamacryl-isobutyl, bialaphos, binapacryl, biphenyl, bitertanol, blastidicidin-S, bromuconazole, bupirimate, buthiobate,
- 15      calcium polysulphide, capsimycin, captafol, captan, carbendazim, carboxin, carvon, quinomethionate, chlobenthiazole, chlorfenazole, chloroneb, chloropicrin, chlorothalonil, chlozolate, clozylacon, cufraneb, cymoxanil, cyproconazole, cyprodinil, cyprofuram,
- 20      debacarb, dichlorophen, diclobutrazole, diclofluanid, diclomezine, dicloran, diethofencarb, difenoconazole, dimethirimol, dimethomorph, diniconazole, diniconazole-M, dinocap, diphenylamine, dipyrithione, ditalimfos, dithianon, dodemorph, dodine, drazoxolon,
- 25      ediphenphos, epoxiconazole, etaconazole, ethirimol, etridiazole,
- 30      famoxadon, fenapanil, fenarimol, fenbuconazole, fenfuram, fenitropan, fenciclonil, fenpropidin, fenpropimorph, fentin acetate, fentin hydroxide, ferbam, ferimzone, fluazinam, flumetover, fluoromide, fluquinconazole, flurprimidol, flusilazole, flusulfamide, flutolanil, flutriafol, folpet, fosetyl-aluminium, fosetyl-sodium, fthalide, fuberidazole, furalaxyl, furametpyr, furcarbonil, furconazole, furconazole-cis, furmecyclox,
- 30      guazatine,

hexachlorobenzene, hexaconazole, hymexazole,

5 imazalil, imibenconazole, iminoctadine, iminoctadine albesilate, iminoctadine triacetate, iodocarb, ipconazole, iprobenfos (IBP), iprodione, irumamycin, isoprothiolane, isovaledione,

10 kasugamycin, kresoxim-methyl, copper preparations, such as: copper hydroxide, copper naphthenate, copper oxychloride, copper sulphate, copper oxide, oxine-copper and Bordeaux mixture,

mancopper, mancozeb, maneb, meferimzone, mepanipyrim, mepronil, metalaxyl, metconazole, methasulfocarb, methfuroxam, metiram, metomeclam, metsulfovax, mildiomicin, myclobutanil, myclozolin,

15 nickel dimethyldithiocarbamate, nitrothal-isopropyl, nuarimol,

ofurace, oxadixyl, oxamocarb, oxolinic acid, oxycarboxim, oxyfenthiin,

20 paclobutrazole, pefurazoate, penconazole, pencycuron, phosdiphen, picoxystrobin, pimaricin, piperalin, polyoxin, polyoxorim, probenazole, prochloraz, procymidone, propamocarb, propanosine-sodium, propiconazole, propineb, pyraclostrobin, pyrazophos, pyrifenox, pyrimethanil, pyroquilon, pyroxyfur,

25 quinconazole, quintozone (PCNB),

sulphur and sulphur preparations,

30 tebuconazole, tecloftalam, tecnazene, tetcyclacis, tetraconazole, thiabendazole, thicyofen, thifluzamide, thiophanate-methyl, thiram, tioxyimid, tolclofos-methyl, tolylfluanid, triadimefon, triadimenol, triazbutil, triazoxide, trichlamide, tricyclazole, tridemorph, trifloxystrobin, triflumizole, triforine, triticonazole,

uniconazole,

validamycin A, vinclozolin, viniconazole,

5

zarilamide, zineb, ziram and also

Dagger G,

10

OK-8705,

OK-8801,

$\alpha$ -(1,1-dimethylethyl)- $\beta$ -(2-phenoxyethyl)-1H-1,2,4-triazole-1-ethanol,

$\alpha$ -(2,4-dichlorophenyl)- $\beta$ -fluoro- $\beta$ -propyl-1H-1,2,4-triazole-1-ethanol,

15

$\alpha$ -(2,4-dichlorophenyl)- $\beta$ -methoxy- $\alpha$ -methyl-1H-1,2,4-triazole-1-ethanol,

$\alpha$ -(5-methyl-1,3-dioxan-5-yl)- $\beta$ -[[4-(trifluoromethyl)-phenyl]-methylene]-  
1H-1,2,4-triazole-1-ethanol,

(5RS,6RS)-6-hydroxy-2,2,7,7-tetramethyl-5-(1H-1,2,4-triazol-1-yl)-3-octanone,

20

(E)- $\alpha$ -(methoxyimino)-N-methyl-2-phenoxy-phenylacetamide,

1-isopropyl {2-methyl-1-[[[1-(4-methylphenyl)-ethyl]-amino]-carbonyl]-propyl}-  
carbamate,

25

1-(2,4-dichlorophenyl)-2-(1H-1,2,4-triazol-1-yl)-ethanone-O-(phenylmethyl)-oxime,

1-(2-methyl-1-naphthalenyl)-1H-pyrrol-2,5-dione,

1-(3,5-dichlorophenyl)-3-(2-propenyl)-2,5-pyrrolidindione,

1-[(diiodomethyl)-sulphonyl]-4-methylbenzene,

1-[[2-(2,4-dichlorophenyl)-1,3-dioxolan-2-yl]-methyl]-1H-imidazole,

30

1-[[2-(4-chlorophenyl)-3-phenyloxiranyl]-methyl]-1H-1,2,4-triazole,

1-[1-[2-[(2,4-dichlorophenyl)-methoxy]-phenyl]-ethenyl]-1H-imidazole,

- 1-methyl-5-nonyl-2-(phenylmethyl)-3-pyrrolidinole,  
 2',6'-dibromo-2-methyl-4'-trifluoromethoxy-4'-trifluoromethyl-1,3-thiazole-  
 5-carboxanilide,  
 2,2-dichloro-N-[1-(4-chlorophenyl)-ethyl]-1-ethyl-3-methyl-  
 5 cyclopropanecarboxamide,  
 2,6-dichloro-5-(methylthio)-4-pyrimidinyl-thiocyanate,  
 2,6-dichloro-N-(4-trifluoromethylbenzyl)-benzamide,  
 2,6-dichloro-N-[[4-(trifluoromethyl)-phenyl]-methyl]-benzamide,  
 2-(2,3,3-triiodo-2-propenyl)-2H-tetrazole,  
 10 2-[(1-methylethyl)-sulphonyl]-5-(trichloromethyl)-1,3,4-thiadiazole,  
 2-[[6-deoxy-4-O-(4-O-methyl-β-D-glycopyranosyl)-α-D-glucopyranosyl]-amino]-  
 4-methoxy-1H-pyrrolo[2,3-d]pyrimidine-5-carbonitrile,  
 2-aminobutane,  
 2-bromo-2-(bromomethyl)-pentanedinitrile,  
 15 2-chloro-N-(2,3-dihydro-1,1,3-trimethyl-1H-inden-4-yl)-3-pyridinecarboxamide,  
 2-chloro-N-(2,6-dimethylphenyl)-N-(isothiocyanatomethyl)-acetamide,  
 2-phenylphenol (OPP),  
 3,4-dichloro-1-[4-(difluoromethoxy)-phenyl]-1H-pyrrol-2,5-dione,  
 3,5-dichloro-N-[cyano[(1-methyl-2-propynyl)-oxy]-methyl]-benzamide,  
 20 3-(1,1-dimethylpropyl)-1-oxo-1H-indene-2-carbonitrile,  
 3-[2-(4-chlorophenyl)-5-ethoxy-3-isoxazolidinyl]-pyridine,  
 4-chloro-2-cyano-N,N-dimethyl-5-(4-methylphenyl)-1H-imidazole-1-sulphonamide,  
 4-methyltetrazolo[1,5-a]quinazolin-5(4H)-one,  
 8-(1,1-dimethylethyl)-N-ethyl-N-propyl-1,4-dioxaspiro[4.5]decane-2-methanamine,  
 25 8-hydroxyquinoline sulphate,  
 9H-xanthene-2-[(phenylamino)-carbonyl]-9-carboxylic hydrazide,  
 bis-(1-methylethyl)-3-methyl-4-[(3-methylbenzoyl)-oxy]-2,5-thiophenedicarboxylate,  
 cis-1-(4-chlorophenyl)-2-(1H-1,2,4-triazol-1-yl)-cycloheptanol,  
 cis-4-[3-[4-(1,1-dimethylpropyl)-phenyl-2-methylpropyl]-2,6-dimethylmorpholine  
 30 hydrochloride,  
 ethyl [(4-chlorophenyl)-azo]-cyanoacetate,

- potassium bicarbonate,  
methanetetrahiol-sodium salt,  
methyl 1-(2,3-dihydro-2,2-dimethyl-1H-inden-1-yl)-1H-imidazole-5-carboxylate,  
methyl N-(2,6-dimethylphenyl)-N-(5-isoxazolylcarbonyl)-DL-alaninate,  
5 methyl N-(chloroacetyl)-N-(2,6-dimethylphenyl)-DL-alaninate,  
N-(2,3-dichloro-4-hydroxyphenyl)-1-methyl-cyclohexanecarboxamide,  
N-(2,6-dimethylphenyl)-2-methoxy-N-(tetrahydro-2-oxo-3-furanyl)-acetamide,  
N-(2,6-dimethylphenyl)-2-methoxy-N-(tetrahydro-2-oxo-3-thienyl)-acetamide,  
N-(2-chloro-4-nitrophenyl)-4-methyl-3-nitrobenzenesulphonamide,  
10 N-(4-cyclohexylphenyl)-1,4,5,6-tetrahydro-2-pyrimidinamine,  
N-(4-hexylphenyl)-1,4,5,6-tetrahydro-2-pyrimidinamine,  
N-(5-chloro-2-methylphenyl)-2-methoxy-N-(2-oxo-3-oxazolidinyl)-acetamide,  
N-(6-methoxy)-3-pyridinyl-cyclopropanecarboxamide,  
N-[2,2,2-trichloro-1-[(chloroacetyl)-amino]-ethyl]-benzamide,  
15 N-[3-chloro-4,5-bis(2-propinyloxy)-phenyl]-N'-methoxymethanimidamide,  
N-formyl-N-hydroxy-DL-alanine-sodium salt,  
O,O-diethyl [2-(dipropylamino)-2-oxoethyl]-ethylphosphoramidothioate,  
O-methyl S-phenyl phenylpropylphosphoramidothioate,  
S-methyl 1,2,3-benzothiadiazole-7-carbothioate,  
20 spiro[2H]-1-benzopyrane-2,1'(3'H)-isobenzofuran]-3'-one,  
4-[3,4-dimethoxyphenyl-3-(4-fluorophenyl)-acryloyl]-morpholine

**Bactericides:**

- 25 bronopol, dichlorophen, nitrapyrin, nickel dimethyldithiocarbamate, kasugamycin,  
ochthilnone, furancarboxylic acid, oxytetracyclin, probenazole, streptomycin,  
tecloftalam, copper sulphate and other copper preparations.

**Insecticides / acaricides / nematocides:**

abamectin, acephate, acetamiprid, acequinocyl, acrinathrin, alanycarb, aldicarb, aldoxycarb, alpha-cypermethrin, alphamethrin, amitraz, avermectin, AZ 60541, azadirachtin, azamethiphos, azinphos A, azinphos M, azocyclotin,

5 Bacillus popilliae, Bacillus sphaericus, Bacillus subtilis, Bacillus thuringiensis, baculoviruses, Beauveria bassiana, Beauveria tenella, bendiocarb, benfuracarb, bensultap, benzoximate, betacyfluthrin, bifenazate, bifenthrin, bioethanomethrin, biopermethrin, bistrifluron, BPMC, bromophos A, bufencarb, buprofezin, butathiofos, butocarboxim, butylpyridaben,

10 cadusafos, carbaryl, carbofuran, carbophenothion, carbosulfan, cartap, chloethocarb, chlorethoxyfos, chlorfenapyr, chlorfenvinphos, chlorfluazuron, chlormephos, chlorpyrifos, chlorpyrifos M, chlovaporthrin, chromafenozide, cis-resmethrin, cispermethrin, clocythrins, cloethocarb, clofentezine, clothianidine, cyanophos, 15 cycloprene, cycloprothrin, cyfluthrin, cyhalothrin, cyhexatin, cypermethrin, cyromazine,

deltamethrin, demeton M, demeton S, demeton-S-methyl, diafenthiuron, diazinon, dichlorvos, dicofol, diflubenzuron, dimethoate, dimethylvinphos, dinetofuran, 20 diofenolan, disulfoton, docusat-sodium, dofenapyn,

eflusalate, emamectin, empenthrin, endosulfan, Entomopffthora spp., esfenvalerate, ethiofencarb, ethion, ethiprole, ethoprophos, etofenprox, etoxazole, etrimfos,

25 fenamiphos, fenazaquin, fenbutatin oxide, fenitrothion, fenothiocab, fenoxacrim, fenoxycarb, fenpropathrin, fenpyrad, fenpyrithrin, fenpyroximate, fenthion, fenvalerate, fipronil, fluazinam, fluazuron, flubrocylthrin, flucyclohexuron, flucythrinate, flufenoxuron, flumethrin, flupyrzofos, flutenzine, fluvalinate, fonophos, fosmethilan, fothiazate, fubfenprox, furathiocab,

30 granulosus viruses,

- halofenozide, HCH, heptenophos, hexaflumuron, hexythiazox, hydroprene,
- imidacloprid, indoxacarb, isazofos, isofenphos, isoxathion, ivermectin,
- 5 nuclear polyhedrosis viruses,
- lambda-cyhalothrin, lufenuron,
- 10 malathion, mecarbam, metaldehyde, methamidophos, Metharhizium anisopliae, metharhizium flavoviride, methidathion, methiocarb, methoprene, methomyl, methoxyfenozide, metolcarb, metoxadiazone, mevinphos, milbemectin, milbemycin, monocrotophos,
- 15 naled, nitenpyram, nithiazine, novaluron,
- omethoate, oxamyl, oxydemethon M,
- 20 Paecilomyces fumosoroseus, parathion A, parathion M, permethrin, phenthoate, phorate, phosalone, phosmet, phosphamidon, phoxim, pirimicarb, pirimiphos A, pirimiphos M, profenofos, promecarb, propargite, propoxur, prothiofos, prothoate, pymetrozine, pyraclofos, pyresmethrin, pyrethrum, pyridaben, pyridathion, pyrimidifen, pyriproxyfen,
- 25 quinalphos,
- ribavirin,
- salithion, sebufos, silafluofen, spinosad, spiroticlofen, sulfotep, sulprofos,

- tau-fluvalinate, tebufenozide, tebufenpyrad, tebupirimiphos, teflubenzuron,  
tefluthrin, temephos, temvinphos, terbufos, tetrachlorvinphos, tetradifon, theta-  
cypermethrin, thiacloprid, thiamethoxam, thiapronil, thiatriphos, thiocyclam  
hydrogen oxalate, thiodicarb, thiofanox, thuringiensin, tralocythrin, tralomethrin,  
5 triarathene, triazamate, triazophos, triazuron, trichlophenidine, trichlorfon,  
triflumuron, trimethacarb,  
  
vamidothion, vaniliprole, Verticillium lecanii,  
  
10 YI 5302,  
  
zeta-cypermethrin, zolaprofos,  
  
(1R-cis)-[5-(phenylmethyl)-3-furanyl]-methyl-3-[(dihydro-2-oxo-3(2H)-  
15 furanylidene)-methyl]-2,2-dimethylcyclopropanecarboxylate,  
  
(3-phenoxyphenyl)-methyl-2,2,3,3-tetramethylcyclopropanecarboxylate,  
  
1-[(2-chloro-5-thiazolyl)methyl]tetrahydro-3,5-dimethyl-N-nitro-1,3,5-triazine-  
20 2(1H)-imine,  
  
2-(2-chloro-6-fluorophenyl)-4-[4-(1,1-dimethylethyl)phenyl]-4,5-dihydro-oxazole,  
2-(acetyloxy)-3-dodecyl-1,4-naphthalenedione,  
2-chloro-N-[[[4-(1-phenylethoxy)-phenyl]-amino]-carbonyl]-benzamide,  
25 2-chloro-N-[[[4-(2,2-dichloro-1,1-difluoroethoxy)-phenyl]-amino]-carbonyl]-  
benzamide,  
3-methylphenyl propylcarbamate,  
4-[4-(4-ethoxyphenyl)-4-methylpentyl]-1-fluoro-2-phenoxybenzene,  
4-chloro-2-(1,1-dimethylethyl)-5-[[2-(2,6-dimethyl-4-phenoxyphenoxy)ethyl]thio]-  
30 3(2H)-pyridazinone,



- 4-chloro-2-(2-chloro-2-methylpropyl)-5-[(6-iodo-3-pyridinyl)methoxy]-  
3(2H)-pyridazinone,  
4-chloro-5-[(6-chloro-3-pyridinyl)methoxy]-2-(3,4-dichlorophenyl)-  
3(2H)-pyridazinone,  
5 Bacillus thuringiensis strain EG-2348,  
[2-benzoyl-1-(1,1-dimethylethyl)-hydrazinobenzoic acid,  
2,2-dimethyl-3-(2,4-dichlorophenyl)-2-oxo-1-oxaspiro[4.5]dec-3-en-4-yl butanoate,  
[3-[(6-chloro-3-pyridinyl)methyl]-2-thiazolidinylidene]-cyanamide,  
dihydro-2-(nitromethylene)-2H-1,3-thiazine-3(4H)-carboxaldehyde,  
10 ethyl [2-[[1,6-dihydro-6-oxo-1-(phenylmethyl)-4-pyridazinyl]oxy]ethyl]-carbamate,  
N-(3,4,4-trifluoro-1-oxo-3-butenyl)-glycine,  
N-(4-chlorophenyl)-3-[4-(difluoromethoxy)phenyl]-4,5-dihydro-4-phenyl-  
1H-pyrazole-1-carboxamide,  
N-[(2-chloro-5-thiazolyl)methyl]-N'-methyl-N''-nitro-guanidine,  
15 N-methyl-N'-(1-methyl-2-propenyl)-1,2-hydrazinedicarbothioamide,  
N-methyl-N'-2-propenyl-1,2-hydrazinedicarbothioamide,  
O,O-diethyl-[2-(dipropylamino)-2-oxoethyl]-ethylphosphoramidothioate,  
N-cyanomethyl-4-trifluoromethyl-nicotinamide,  
3,5-dichloro-1-(3,3-dichloro-2-propenyloxy)-4-[3-(5-trifluoromethylpyridin-2-  
20 yloxy)-propoxy]-benzene.

It is also possible to admix other known active compounds, such as herbicides, fertilizers and growth regulators, or safeners or semiochemicals.

- 25 When used as insecticides, the active compounds according to the invention can furthermore be present in their commercially available formulations and in the use forms, prepared from these formulations, as a mixture with synergistic agents. Synergistic agents are compounds which increase the action of the active compounds, without it being necessary for the synergistic agent added to be active itself.

When used as insecticides, the active compounds according to the invention can furthermore be present in their commercially available formulations and in the use forms, prepared from these formulations, as a mixture with inhibitors which reduce the degradation of the active compound after use in the vicinity of the plant, on the surface of parts of plants or in plant tissues.

The active compound content of the use forms prepared from the commercially available formulations can vary within wide limits. The active compound concentration of the use forms can be from 0.0000001 to 95% by weight of active compound, preferably between 0.0001 and 1% by weight.

The compounds are employed in a customary manner appropriate for the use forms.

When used against hygiene pests and pests of stored products, the active compound is distinguished by an excellent residual action on wood and clay as well as by a good stability to alkali on limed substrates.

As already mentioned above, it is possible to treat all plants and their parts according to the invention. In a preferred embodiment, wild plant species and plant cultivars, or those obtained by conventional biological breeding, such as crossing or protoplast fusion, and parts thereof, are treated. In a further preferred embodiment, transgenic plants and plant cultivars obtained by genetic engineering, if appropriate in combination with conventional methods (Genetically Modified Organisms), and parts thereof are treated. The term "parts" or "parts of plants" or "plant parts" has been explained above.

Particularly preferably, plants of the plant cultivars which are in each case commercially available or in use are treated according to the invention. Plant cultivars are understood as meaning plants with novel properties ("traits") which are grown by conventional cultivation, by mutagenesis or by recombinant DNA techniques. These may be cultivars, biotypes or genotypes.

Depending on the plant species or plant cultivars, their location and growth conditions (soils, climate, vegetation period, diet), the treatment according to the invention may also result in superadditive ("synergistic") effects. Thus, for example, reduced application rates and/or a widening of the activity spectrum and/or an increase in the activity of the substances and compositions to be used according to the invention, better plant growth, increased tolerance to high or low temperatures, increased tolerance to drought or to water or soil salt content, increased flowering performance, easier harvesting, accelerated maturation, higher harvest yields, better quality and/or a higher nutritional value of the harvested products, better storage stability and/or processability of the harvested products are possible which exceed the effects which were actually to be expected.

The transgenic plants or plant cultivars (i.e. those obtained by genetic engineering) which are preferably to be treated according to the invention include all plants which, in the genetic modification, received genetic material which imparts particularly advantageous useful properties ("traits") to these plants. Examples of such properties are better plant growth, increased tolerance to high or low temperatures, increased tolerance to drought or to water or soil salt content, increased flowering performance, easier harvesting, accelerated maturation, higher harvest yields, better quality and/or a higher nutritional value of the harvested products, better storage stability and/or processability of the harvested products. Further and particularly emphasized examples of such properties are a better defence of the plants against animal and microbial pests, such as against insects, mites, phytopathogenic fungi, bacteria and/or viruses, and also increased tolerance of the plants to certain herbicidally active compounds. Examples of transgenic plants which may be mentioned are the important crop plants, such as cereals (wheat, rice), maize, soya beans, potatoes, cotton, tobacco, oilseed rape and also fruit plants (with the fruits apples, pears, citrus fruits and grapes), and particular emphasis is given to maize, soya beans, potatoes, cotton, tobacco and oilseed rape. Traits that are emphasized are in particular increased defence of the plants against insects, arachnids, nematodes and slugs and snails by toxins formed in the plants, in particular those formed in the plants by the

genetic material from *Bacillus thuringiensis* (for example by the genes CryIA(a), CryIA(b), CryIA(c), CryIIA, CryIIIA, CryIIIB2, Cry9c Cry2Ab, Cry3Bb and CryIF and also combinations thereof) (hereinbelow referred to as "Bt plants"). Traits which are also particularly emphasized are the increased resistance of plants to fungi, bacteria and viruses by systemic acquired resistance (SAR), systemin, phytoalexins, elicitors and resistance genes and the correspondingly expressed proteins and toxins. Traits that are furthermore particularly emphasized are the increased tolerance of the plants to certain herbicidally active compounds, for example imidazolinones, sulphonylureas, glyphosate or phosphinotricin (for example the "PAT" gene). The genes which impart the desired traits in question can also be present in combinations with one another in the transgenic plants. Examples of "Bt plants" which may be mentioned are maize varieties, cotton varieties, soya bean varieties and potato varieties which are sold under the trade names YIELD GARD® (for example maize, cotton, soya beans), KnockOut® (for example maize), StarLink® (for example maize), Bollgard® (cotton), Nucotn® (cotton) and NewLeaf® (potato). Examples of herbicide-tolerant plants which may be mentioned are maize varieties, cotton varieties and soya bean varieties which are sold under the trade names Roundup Ready® (tolerance to glyphosate, for example maize, cotton, soya bean), Liberty Link® (tolerance to phosphinotricin, for example oilseed rape), IMI® (tolerance to imidazolinones) and STS® (tolerance to sulphonylureas, for example maize). Herbicide-resistant plants (plants bred in a conventional manner for herbicide tolerance) which may be mentioned include the varieties sold under the name Clearfield® (for example maize). Of course, these statements also apply to plant cultivars having these genetic traits or genetic traits still to be developed, which cultivars will be developed and/or marketed in the future.

The plants listed can be treated according to the invention in a particularly advantageous manner with the compounds of the formula I or the active compound mixtures according to the invention. The preferred ranges stated above for the active compounds or mixtures also apply to the treatment of these plants. Particular

emphasis is given to the treatment of plants with the compounds or mixtures specifically mentioned in the present text.

The active compounds according to the invention act not only against plant, hygiene  
5 and stored product pests, but also in the veterinary medicine sector against animal  
parasites (ectoparasites), such as hard ticks, soft ticks, mange mites, harvest mites,  
flies (biting and licking), parasitic fly larvae, lice, hair lice, feather lice and fleas.  
These parasites include:

10 From the order of the Anoplurida, for example, *Haematopinus* spp., *Linognathus*  
spp., *Pediculus* spp., *Phthirus* spp. and *Solenopotes* spp.

From the order of the Mallophagida and the suborders Amblycerina and  
Ischnocerina, for example, *Trimenopon* spp., *Menopon* spp., *Trinoton* spp., *Bovicola*  
15 spp., *Werneckiella* spp., *Lepikentron* spp., *Damalina* spp., *Trichodectes* spp. and  
*Felicola* spp.

From the order of the Diptera and the suborders Nematocerina and Brachycerina, for  
example, *Aedes* spp., *Anopheles* spp., *Culex* spp., *Simulium* spp., *Eusimulium* spp.,  
20 *Phlebotomus* spp., *Lutzomyia* spp., *Culicoides* spp., *Chrysops* spp., *Hybomitra* spp.,  
*Atylotus* spp., *Tabanus* spp., *Haematopota* spp., *Philipomyia* spp., *Braula* spp., *Musca*  
spp., *Hydrotaea* spp., *Stomoxys* spp., *Haematobia* spp., *Morellia* spp., *Fannia* spp.,  
*Glossina* spp., *Calliphora* spp., *Lucilia* spp., *Chrysomyia* spp., *Wohlfahrtia* spp.,  
*Sarcophaga* spp., *Oestrus* spp., *Hypoderma* spp., *Gasterophilus* spp., *Hippobosca*  
25 spp., *Lipoptena* spp. and *Melophagus* spp.

From the order of the Siphonaptera, for example *Pulex* spp., *Ctenocephalides* spp.,  
*Xenopsylla* spp. and *Ceratophyllus* spp.

30 From the order of the Heteropterida, for example, *Cimex* spp., *Triatoma* spp.,  
*Rhodnius* spp. and *Panstrongylus* spp.

From the order of the Blattarida, for example *Blatta orientalis*, *Periplaneta americana*, *Blattella germanica* and *Supella* spp.

5 From the subclass of the Acari (Acarina) and the orders of the Meta- and Mesostigmata, for example, *Argas* spp., *Ornithodoros* spp., *Otobius* spp., *Ixodes* spp., *Amblyomma* spp., *Boophilus* spp., *Dermacentor* spp., *Haemophysalis* spp., *Hyalomma* spp., *Rhipicephalus* spp., *Dermanyssus* spp., *Raillietia* spp., *Pneumonyssus* spp., *Sternostoma* spp. and *Varroa* spp.

10 From the order of the Actinedida (Prostigmata) und Acaridida (Astigmata), for example, *Acarapis* spp., *Cheyletiella* spp., *Ornithocheyletia* spp., *Myobia* spp., *Psorergates* spp., *Demodex* spp., *Trombicula* spp., *Listrophorus* spp., *Acarus* spp., *Tyrophagus* spp., *Caloglyphus* spp., *Hypodectes* spp., *Pterolichus* spp., *Psoroptes* spp., *Chorioptes* spp., *Otodectes* spp., *Sarcoptes* spp., *Notoedres* spp.,  
15 *Knemidocoptes* spp., *Cytodites* spp. and *Laminosioptes* spp.

The active compounds of the formula (I) according to the invention are also suitable for controlling arthropods which infest agricultural productive livestock, such as, for  
20 example, cattle, sheep, goats, horses, pigs, donkeys, camels, buffalo, rabbits, chickens, turkeys, ducks, geese and bees, other pets, such as, for example, dogs, cats, caged birds and aquarium fish, and also so-called test animals, such as, for example, hamsters, guinea pigs, rats and mice. By controlling these arthropods, cases of death and reduction in productivity (for meat, milk, wool, hides, eggs, honey etc.) should  
25 be diminished, so that more economic and easier animal husbandry is possible by use of the active compounds according to the invention.

The active compounds according to the invention are used in the veterinary sector in a known manner by enteral administration in the form of, for example, tablets,  
30 capsules, potions, drenches, granules, pastes, boluses, the feed-through process and suppositories, by parenteral administration, such as, for example, by injection

(intramuscular, subcutaneous, intravenous, intraperitoneal and the like), implants, by nasal administration, by dermal use in the form, for example, of dipping or bathing, spraying, pouring on and spotting on, washing and powdering, and also with the aid of moulded articles containing the active compound, such as collars, ear marks, tail marks, limb bands, halters, marking devices and the like.

When used for cattle, poultry, pets and the like, the active compounds of the formula (I) can be used as formulations (for example powders, emulsions, free-flowing compositions), which comprise the active compounds in an amount of 1 to 80% by weight, directly or after 100 to 10 000-fold dilution, or they can be used as a chemical bath.

It has furthermore been found that the compounds according to the invention have a strong insecticidal action against insects which destroy industrial materials.

The following insects may be mentioned as examples and as preferred - but without limitation:

Beetles, such as  
Hylotrupes bajulus, Chlorophorus pilosis, Anobium punctatum, Xestobium rufovillosum, Ptilinus pecticornis, Dendrobium pertinex, Ernobius mollis, Priobium carpini, Lyctus brunneus, Lyctus africanus, Lyctus planicollis, Lyctus linearis, Lyctus pubescens, Trogoxylon aequale, Minthes rugicollis, Xyleborus spec. Tryptodendron spec. Apate monachus, Bostrychus capucins, Heterobostrychus brunneus, Sinoxylon spec. Dinoderus minutus.

Hymenopterons, such as  
Sirex juvencus, Urocerus gigas, Urocerus gigas taignus, Urocerus augur.

Termites, such as

Kaloterme flavicollis, Cryptoterme brevis, Heteroterme indicola, Reticuliterme flavipes, Reticuliterme santonensis, Reticuliterme lucifugus, Mastoterme darwiniensis, Zootermopsis nevadensis, Coptoterme formosanus.

5 Bristletails, such as Lepisma saccharina.

Industrial materials in the present connection are to be understood as meaning non-living materials, such as, preferably, plastics, adhesives, sizes, paper and card, leather, wood and processed wood products and coating compositions.

10

Wood and processed wood products are materials to be protected, especially preferably, from insect infestation.

15

Wood and processed wood products which can be protected by the agent according to the invention or mixtures comprising this are to be understood as meaning, for example:

20

building timber, wooden beams, railway sleepers, bridge components, boat jetties, wooden vehicles, boxes, pallets, containers, telegraph poles, wood panelling, wooden windows and doors, plywood, chipboard, joinery or wooden products which are used quite generally in house-building or in building joinery.

25

The active compounds can be used as such, in the form of concentrates or generally customary formulations, such as powders, granules, solutions, suspensions, emulsions or pastes.

30

The formulations mentioned can be prepared in a manner known per se, for example by mixing the active compounds with at least one solvent or diluent, emulsifier, dispersing agent and/or binder or fixing agent, a water repellent, if appropriate siccatives and UV stabilizers and if appropriate dyestuffs and pigments, and also other processing auxiliaries.



5 The insecticidal compositions or concentrates used for the preservation of wood and wood-derived timber products comprise the active compound according to the invention in a concentration of 0.0001 to 95% by weight, in particular 0.001 to 60% by weight.

10 The amount of the compositions or concentrates employed depends on the nature and occurrence of the insects and on the medium. The optimum amount employed can be determined for the use in each case by a series of tests. In general, however, it is sufficient to employ 0.0001 to 20% by weight, preferably 0.001 to 10% by weight, of the active compound, based on the material to be preserved.

15 Solvents and/or diluents which are used are an organic-chemical solvent or solvent mixture and/or an oily or oil-like organic-chemical solvent or solvent mixture of low volatility and/or a polar organic-chemical solvent or solvent mixture and/or water, and if appropriate an emulsifier and/or wetting agent.

20 Organic-chemical solvents which are preferably used are oily or oil-like solvents having an evaporation number above 35 and a flashpoint above 30°C, preferably above 45°C. Substances which are used as such oily or oil-like water-insoluble solvents of low volatility are appropriate mineral oils or aromatic fractions thereof, or solvent mixtures containing mineral oils, preferably white spirit, petroleum and/or alkylbenzene.

25 Mineral oils having a boiling range from 170 to 220°C, white spirit having a boiling range from 170 to 220°C, spindle oil having a boiling range from 250 to 350°C, petroleum and aromatics having a boiling range from 160 to 280°C, terpentine oil and the like, are advantageously employed.

30 In a preferred embodiment, liquid aliphatic hydrocarbons having a boiling range from 180 to 210°C or high-boiling mixtures of aromatic and aliphatic hydrocarbons having

a boiling range from 180 to 220°C and/or spindle oil and/or monochloronaphthalene, preferably  $\alpha$ -monochloronaphthalene, are used.

5 The organic oily or oil-like solvents of low volatility which have an evaporation number above 35 and a flashpoint above 30°C, preferably above 45°C, can be replaced in part by organic-chemical solvents of high or medium volatility, providing that the solvent mixture likewise has an evaporation number above 35 and a flashpoint above 30°C, preferably above 45°C, and that the insecticide/fungicide mixture is soluble or emulsifiable in this solvent mixture.

10

According to a preferred embodiment, some of the organic-chemical solvent or solvent mixture or an aliphatic polar organic-chemical solvent or solvent mixture is replaced. Aliphatic organic-chemical solvents containing hydroxyl and/or ester and/or ether groups, such as, for example, glycol ethers, esters or the like, are preferably used.

15

20

Organic-chemical binders which are used in the context of the present invention are the synthetic resins and/or binding drying oils which are known per se, are water-dilutable and/or are soluble or dispersible or emulsifiable in the organic-chemical solvents employed, in particular binders consisting of or comprising an acrylate resin, a vinyl resin, for example polyvinyl acetate, polyester resin, polycondensation or polyaddition resin, polyurethane resin, alkyd resin or modified alkyd resin, phenolic resin, hydrocarbon resin, such as indene-cumarone resin, silicone resin, drying vegetable oils and/or drying oils and/or physically drying binders based on a natural and/or synthetic resin.

25

30

The synthetic resin used as the binder can be employed in the form of an emulsion, dispersion or solution. Bitumen or bituminous substances can also be used as binders in an amount of up to 10% by weight. Dyestuffs, pigments, water-repelling agents, odour correctants and inhibitors or anticorrosive agents and the like which are known per se can additionally be employed.

It is preferred according to the invention for the composition or concentrate to comprise, as the organic-chemical binder, at least one alkyd resin or modified alkyd resin and/or one drying vegetable oil. Alkyd resins having an oil content of more than  
5 45% by weight, preferably 50 to 68% by weight, are preferably used according to the invention.

All or some of the binder mentioned can be replaced by a fixing agent (mixture) or a plasticizer (mixture). These additives are intended to prevent evaporation of the  
10 active compounds and crystallization or precipitation. They preferably replace 0.01 to 30% of the binder (based on 100% of the binder employed).

The plasticizers originate from the chemical classes of phthalic acid esters, such as dibutyl, dioctyl or benzyl butyl phthalate, phosphoric acid esters, such as tributyl  
15 phosphate, adipic acid esters, such as di-(2-ethylhexyl) adipate, stearates, such as butyl stearate or amyl stearate, oleates, such as butyl oleate, glycerol ethers or higher molecular weight glycol ethers, glycerol esters and p-toluenesulphonic acid esters.

Fixing agents are based chemically on polyvinyl alkyl ethers, such as, for example,  
20 polyvinyl methyl ether or ketones, such as benzophenone or ethylenebenzophenone.

Possible solvents or diluents are, in particular, also water, if appropriate as a mixture with one or more of the abovementioned organic-chemical solvents or diluents, emulsifiers and dispersing agents.  
25

Particularly effective preservation of wood is achieved by impregnation processes on a large industrial scale, for example vacuum, double vacuum or pressure processes.

The ready-to-use compositions can also comprise other insecticides, if appropriate,  
30 and also one or more fungicides, if appropriate.

Possible additional mixing partners are, preferably, the insecticides and fungicides mentioned in WO 94/29 268. The compounds mentioned in this document are an explicit constituent of the present application.

5 Especially preferred mixing partners which may be mentioned are insecticides, such as chlorpyrifos, phoxim, silafluofin, alphamethrin, cyfluthrin, cypermethrin, deltamethrin, permethrin, imidacloprid, NI-25, flufenoxuron, hexaflumuron, transfluthrin, thiacloprid, methoxyphenoxide, triflumuron, chlothianidin, spinosad and tefluthrin,

10

and also fungicides, such as epoxyconazole, hexaconazole, azaconazole, propiconazole, tebuconazole, cyproconazole, metconazole, imazalil, dichlorfluanid, tolylfluanid, 3-iodo-2-propinyl-butylcarbamate, N-octyl-isothiazolin-3-one and 4,5-dichloro-N-octylisothiazolin-3-one.

15

The compounds according to the invention can at the same time be employed for protecting objects which come into contact with saltwater or brackish water, in particular hulls, screens, nets, buildings, moorings and signalling systems, against fouling.

20

Fouling by sessile Oligochaeta, such as Serpulidae, and by shells and species from the Ledamorpha group (goose barnacles), such as various Lepas and Scalpellum species, or by species from the Balanomorpha group (acorn barnacles), such as Balanus or Pollicipes species, increases the frictional drag of ships and, as a  
25 consequence, leads to a marked increase in operation costs owing to higher energy consumption and additionally frequent residence in the dry dock.

25

Apart from fouling by algae, for example Ectocarpus sp. and Ceramium sp., in particular fouling by sessile Entomostraka groups, which come under the generic  
30 term Cirripedia (cirriped crustaceans), is of particular importance.

30

Surprisingly, it has now been found that the compounds according to the invention, alone or in combination with other active compounds, have an outstanding antifouling action.

5 Using the compounds according to the invention, alone or in combination with other active compounds, allows the use of heavy metals such as, for example, in bis(trialkyltin) sulphides, tri-n-butyltin laurate, tri-n-butyltin chloride, copper(I) oxide, triethyltin chloride, tri-n-butyl(2-phenyl-4-chlorophenoxy)tin, tributyltin oxide, molybdenum disulphide, antimony oxide, polymeric butyl titanate,  
10 phenyl(bispyridine)bismuth chloride, tri-n-butyltin fluoride, manganese ethylenebisthiocarbamate, zinc dimethyldithiocarbamate, zinc ethylenebisthiocarbamate, zinc salts and copper salts of 2-pyridinethiol 1-oxide, bisdimethyldithiocarbamoylzinc ethylenebisthiocarbamate, zinc oxide, copper(I) ethylenebisdithiocarbamate, copper thiocyanate, copper naphthenate and tributyltin  
15 halides to be dispensed with, or the concentration of these compounds to be substantially reduced.

If appropriate, the ready-to-use antifouling paints can additionally comprise other active compounds, preferably algicides, fungicides, herbicides, molluscicides, or  
20 other antifouling active compounds.

Preferably suitable components in combinations with the antifouling compositions according to the invention are:

25 algicides such as

2-*tert*-butylamino-4-cyclopropylamino-6-methylthio-1,3,5-triazine, dichlorophen, diuron, endothal, fentin acetate, isoproturon, methabenzthiazuron, oxyfluorfen, quinoclamine and terbutryn;

30

fungicides such as

benzo[*b*]thiophenecarboxylic acid cyclohexylamide S,S-dioxide, dichlofluanid, fluorfolpet, 3-iodo-2-propinyl butylcarbamate, tolylfluanid and azoles such as azaconazole, cyproconazole, epoxyconazole, hexaconazole, metconazole, propiconazole and tebuconazole;

molluscicides such as

fentin acetate, metaldehyde, methiocarb, niclosamid, thiodicarb and trimethacarb ferrate;

or conventional antifouling active compounds such as

4,5-dichloro-2-octyl-4-isothiazolin-3-one, diiodomethylparatryl sulphone, 2-(N,N-dimethylthiocarbamoylthio)-5-nitrothiazyl, potassium, copper, sodium and zinc salts of 2-pyridinethiol 1-oxide, pyridinetriphenylborane, tetrabutyl-distannoxane, 2,3,5,6-tetrachloro-4-(methylsulphonyl)-pyridine, 2,4,5,6-tetrachloroisophthalonitrile, tetramethylthiuram disulphide and 2,4,6-trichlorophenylmaleimide.

The antifouling compositions used comprise the active compound according to the invention of the compounds according to the invention in a concentration of 0.001 to 50% by weight, in particular 0.01 to 20% by weight.

Moreover, the antifouling compositions according to the invention comprise the customary components such as, for example, those described in Ungerer, *Chem. Ind.* 1985, 37, 730-732 and Williams, *Antifouling Marine Coatings*, Noyes, Park Ridge, 1973.

Besides the algicidal, fungicidal, molluscicidal active compounds and insecticidal active compounds according to the invention, antifouling paints comprise, in particular, binders.

Examples of recognized binders are polyvinyl chloride in a solvent system, chlorinated rubber in a solvent system, acrylic resins in a solvent system, in particular in an aqueous system, vinyl chloride/vinyl acetate copolymer systems in the form of aqueous dispersions or in the form of organic solvent systems, butadiene/styrene/acrylonitrile rubbers, drying oils such as linseed oil, resin esters or modified hardened resins in combination with tar or bitumens, asphalt and epoxy compounds, small amounts of chlorine rubber, chlorinated polypropylene and vinyl resins.

If appropriate, paints also comprise inorganic pigments, organic pigments or colorants which are preferably insoluble in salt water. Paints may furthermore comprise materials such as colophonium to allow controlled release of the active compounds. Furthermore, the paints may comprise plasticizers, modifiers which affect the rheological properties and other conventional constituents. The compounds according to the invention or the abovementioned mixtures may also be incorporated into self-polishing antifouling systems.

The active compounds are also suitable for controlling animal pests, in particular insects, arachnids and mites, which are found in enclosed spaces such as, for example, dwellings, factory halls, offices, vehicle cabins and the like. They can be employed alone or in combination with other active compounds and auxiliaries in domestic insecticide products for controlling these pests. They are active against sensitive and resistant species and against all developmental stages. These pests include:

From the order of the Scorpionidea, for example, *Buthus occitanus*.

From the order of the Acarina, for example, *Argas persicus*, *Argas reflexus*, *Bryobia* ssp., *Dermanyssus gallinae*, *Glyciphagus domesticus*, *Ornithodoros moubat*,

*Rhipicephalus sanguineus*, *Trombicula alfreddugesi*, *Neutrombicula autumnalis*,  
*Dermatophagoides pteronissimus*, *Dermatophagoides forinae*.

From the order of the Araneae, for example, *Aviculariidae*, *Araneidae*.

5

From the order of the Opiliones, for example, *Pseudoscorpiones chelifer*,  
*Pseudoscorpiones cheiridium*, *Opiliones phalangium*.

From the order of the Isopoda, for example, *Oniscus asellus*, *Porcellio scaber*.

10

From the order of the Diplopoda, for example, *Blaniulus guttulatus*, *Polydesmus* spp.

From the order of the Chilopoda, for example, *Geophilus* spp.

15

From the order of the Zygentoma, for example, *Ctenolepisma* spp., *Lepisma*  
*saccharina*, *Lepismodes inquilinus*.

From the order of the Blattaria, for example, *Blatta orientalis*, *Blattella germanica*,  
*Blattella asahinai*, *Leucophaea maderae*, *Panchlora* spp., *Parcoblatta* spp., *Periplaneta*  
20 *australasiae*, *Periplaneta americana*, *Periplaneta brunnea*, *Periplaneta fuliginosa*,  
*Supella longipalpa*.

From the order of the Saltatoria, for example, *Acheta domesticus*.

25

From the order of the Dermaptera, for example, *Forficula auricularia*.

From the order of the Isoptera, for example, *Kaloterms* spp., *Reticulitermes* spp.

From the order of the Psocoptera, for example, *Lepinatus* spp., *Liposcelis* spp.

30



From the order of the Coleoptera, for example, *Anthrenus* spp., *Attagenus* spp., *Dermestes* spp., *Latheticus oryzae*, *Necrobia* spp., *Ptinus* spp., *Rhizopertha dominica*, *Sitophilus granarius*, *Sitophilus oryzae*, *Sitophilus zeamais*, *Stegobium paniceum*.

5 From the order of the Diptera, for example, *Aedes aegypti*, *Aedes albopictus*, *Aedes taeniorhynchus*, *Anopheles* spp., *Calliphora erythrocephala*, *Chrysosoma pluvialis*, *Culex quinquefasciatus*, *Culex pipiens*, *Culex tarsalis*, *Drosophila* spp., *Fannia canicularis*, *Musca domestica*, *Phlebotomus* spp., *Sarcophaga carnaria*, *Simulium* spp., *Stomoxys calcitrans*, *Tipula paludosa*.

10

From the order of the Lepidoptera, for example, *Achroia grisella*, *Galleria mellonella*, *Plodia interpunctella*, *Tinea cloacella*, *Tinea pellionella*, *Tineola bisselliella*.

15 From the order of the Siphonaptera, for example, *Ctenocephalides canis*, *Ctenocephalides felis*, *Pulex irritans*, *Tunga penetrans*, *Xenopsylla cheopis*.

From the order of the Hymenoptera, for example, *Camponotus herculeanus*, *Lasius fuliginosus*, *Lasius niger*, *Lasius umbratus*, *Monomorium pharaonis*, *Paravespula* spp., *Tetramorium caespitum*.

20

From the order of the Anoplura, for example, *Pediculus humanus capitis*, *Pediculus humanus corporis*, *Phthirus pubis*.

25 From the order of the Heteroptera, for example, *Cimex hemipterus*, *Cimex lectularius*, *Rhodinus prolixus*, *Triatoma infestans*.

30 In the field of household insecticides, they are used alone or in combination with other suitable active compounds, such as phosphoric acid esters, carbamates, pyrethroids, neonicotinoides, growth regulators or active compounds from other known classes of insecticides.

They are used in aerosols, pressure-free spray products, for example pump and atomizer sprays, automatic fogging systems, foggers, foams, gels, evaporator products with evaporator tablets made of cellulose or polymer, liquid evaporators, gel and membrane evaporators, propeller-driven evaporators, energy-free or passive evaporation systems, moth papers, moth bags and moth gels, as granules or dusts, in baits for spreading or in bait stations.

The active compounds according to the invention can also be used as defoliant, desiccants, haulm killers and, especially, as weedkillers. Weeds in the broadest sense are understood to mean all plants which grow in locations where they are undesired. Whether the substances according to the invention act as total or selective herbicides depends essentially on the amount used.

The active compounds according to the invention can be used, for example, in connection with the following plants:

Dicotyledonous weeds of the genera: Abutilon, Amaranthus, Ambrosia, Anoda, Anthemis, Aphanes, Atriplex, Bellis, Bidens, Capsella, Carduus, Cassia, Centaurea, Chenopodium, Cirsium, Convolvulus, Datura, Desmodium, Emex, Erysimum, Euphorbia, Galeopsis, Galinsoga, Galium, Hibiscus, Ipomoea, Kochia, Lamium, Lepidium, Lindernia, Matricaria, Mentha, Mercurialis, Mullugo, Myosotis, Papaver, Pharbitis, Plantago, Polygonum, Portulaca, Ranunculus, Raphanus, Rorippa, Rotala, Rumex, Salsola, Senecio, Sesbania, Sida, Sinapis, Solanum, Sonchus, Sphenoclea, Stellaria, Taraxacum, Thlaspi, Trifolium, Urtica, Veronica, Viola, Xanthium.

Dicotyledonous crops of the genera: Arachis, Beta, Brassica, Cucumis, Cucurbita, Helianthus, Daucus, Glycine, Gossypium, Ipomoea, Lactuca, Linum, Lycopersicon, Nicotiana, Phaseolus, Pisum, Solanum, Vicia.

Monocotyledonous weeds of the genera: Aegilops, Agropyron, Agrostis, Alopecurus, Apera, Avena, Brachiaria, Bromus, Cenchrus, Commelina, Cynodon, Cyperus,

Dactyloctenium, Digitaria, Echinochloa, Eleocharis, Eleusine, Eragrostis, Eriochloa, Festuca, Fimbristylis, Heteranthera, Imperata, Ischaemum, Leptochloa, Lolium, Monochoria, Panicum, Paspalum, Phalaris, Phleum, Poa, Rottboellia, Sagittaria, Scirpus, Setaria, Sorghum.

5

Monocotyledonous crops of the genera: Allium, Ananas, Asparagus, Avena, Hordeum, Oryza, Panicum, Saccharum, Secale, Sorghum, Triticale, Triticum, Zea.

10

However, the use of the active compounds according to the invention is in no way restricted to these genera, but also extends in the same manner to other plants.

15

The active compounds according to the invention are suitable, depending on the concentration, for the total control of weeds, for example on industrial terrain and rail tracks, and on paths and areas with and without tree plantings. Similarly, the active compounds according to the invention can be employed for controlling weeds in perennial crops, for example forests, decorative tree plantings, orchards, vineyards, citrus groves, nut orchards, banana plantations, coffee plantations, tea plantations, rubber plantations, oil palm plantations, cocoa plantations, soft fruit plantings and hop fields, on lawns, turf and pastureland, and for the selective control of weeds in annual crops.

20

25

The compounds of the formula (I) according to the invention have strong herbicidal activity and a broad activity spectrum when used on the soil and on above-ground parts of plants. To a certain extent they are also suitable for the selective control of monocotyledonous and dicotyledonous weeds in monocotyledonous and dicotyledonous crops, both by the pre-emergence and by the post-emergence method.

30

At certain concentrations or application rates, the active compounds according to the invention can also be employed for controlling animal pests and fungal or bacterial plant diseases. If appropriate, they can also be used as intermediates or precursors for the synthesis of other active compounds.

The active compounds can be converted into the customary formulations such as solutions, emulsions, wettable powders, suspensions, powders, dusts, pastes, soluble powders, granules, suspension-emulsion concentrates, natural and synthetic materials  
5 impregnated with active compound, and microencapsulations in polymeric materials.

These formulations are produced in a known manner, for example by mixing the active compounds with extenders, that is, liquid solvents and/or solid carriers, optionally with the use of surfactants, that is, emulsifiers and/or dispersants, and/or  
10 foam formers.

If the extender used is water, it is also possible to employ, for example, organic solvents as auxiliary solvents. Essentially, suitable liquid solvents are: aromatics such as xylene, toluene or alkylnaphthalenes, chlorinated aromatics and chlorinated  
15 aliphatic hydrocarbons such as chlorobenzenes, chloroethylenes or methylene chloride, aliphatic hydrocarbons such as cyclohexane or paraffins, for example mineral oil fractions, mineral and vegetable oils, alcohols such as butanol or glycol and their ethers and esters, ketones such as acetone, methyl ethyl ketone, methyl isobutyl ketone or cyclohexanone, strongly polar solvents such as  
20 dimethylformamide and dimethyl sulphoxide, or else water.

Suitable solid carriers are: for example ammonium salts and ground natural minerals such as kaolins, clays, talc, chalk, quartz, attapulgite, montmorillonite or diatomaceous earth, and ground synthetic minerals such as finely divided silica,  
25 alumina and silicates; suitable solid carriers for granules are: for example crushed and fractionated natural rocks such as calcite, marble, pumice, sepiolite and dolomite, or else synthetic granules of inorganic and organic meals, and granules of organic material such as sawdust, coconut shells, maize cobs and tobacco stalks; suitable emulsifiers and/or foam formers are: for example nonionic and anionic emulsifiers  
30 such as polyoxyethylene fatty acid esters, polyoxyethylene fatty alcohol ethers, for example alkylaryl polyglycol ethers, alkylsulphonates, alkyl sulphates,

arylsulphonates, or else protein hydrolysates; suitable dispersants are: for example lignosulphite waste liquors and methylcellulose.

5 Tackifiers such as carboxymethylcellulose and natural and synthetic polymers in the form of powders, granules or latices, such as gum arabic, polyvinyl alcohol and polyvinyl acetate, or else natural phospholipids such as cephalins and lecithins and synthetic phospholipids can be used in the formulations. Other possible additives are mineral and vegetable oils.

10 It is possible to use colorants such as inorganic pigments, for example iron oxide, titanium oxide and Prussian Blue, and organic colorants such as alizarin colorants, azo colorants and metal phthalocyanine colorants, and trace nutrients such as salts of iron, manganese, boron, copper, cobalt, molybdenum and zinc.

15 The formulations generally comprise between 0.1 and 95% by weight of active compound, preferably between 0.5 and 90%.

20 For controlling weeds, the active compounds according to the invention, as such or in their formulations, can also be used as mixtures with known herbicides and/or substances which improve the compatibility with crop plants ("safeners"), finished formulations or tank mixes being possible. Also possible are mixtures with weed-killers comprising one or more known herbicides and a safener.

Possible components for the mixtures are known herbicides, for example

25 acetochlor, acifluorfen (-sodium), aclonifen, alachlor, alloxidim (-sodium), ametryne, amicarbazone, amidochlor, amidosulfuron, anilofos, asulam, atrazine, azafenidin, azimsulfuron, beflubutamid, benazolin (-ethyl), benfuresate, bensulfuron (-methyl), bentazon, benzfendizone, benzobicyclon, benzofenap, benzoylprop  
30 (-ethyl), bialaphos, bifenox, bispyribac (-sodium), bromobutide, bromofenoxim, bromoxynil, butachlor, butafenacil (-allyl), butroxydim, butylate, cafenstrole,

caloxydim, carbetamide, carfentrazone (-ethyl), chlomethoxyfen, chloramben, chloridazon, chlorimuron (-ethyl), chlornitrofen, chlorsulfuron, chlortoluron, cinidon (-ethyl), cinmethylin, cinosulfuron, clefoxydim, clethodim, clodinafop (-propargyl), clomazone, clomeprop, clopyralid, clopyrasulfuron (-methyl), cloransulam (-methyl),  
5 cumyluron, cyanazine, cybutryne, cycloate, cyclosulfamuron, cycloxydim, cyhalofop (-butyl), 2,4-D, 2,4-DB, desmedipham, diallate, dicamba, dichlorprop (-P), diclofop (-methyl), diclosulam, diethatyl (-ethyl), difenzoquat, diflufenican, diflufenzopyr, dimefuron, dimepiperate, dimethachlor, dimethametryn, dimethenamid, dimexyflam, dinitramine, diphenamid, diquat, dithiopyr, diuron, dymron, epropodan, EPTC,  
10 esprocarb, ethalfluralin, ethametsulfuron (-methyl), ethofumesate, ethoxyfen, ethoxysulfuron, etobenzanid, fenoxaprop (-P-ethyl), fentrazamide, flamprop (-isopropyl, -isopropyl-L, -methyl), flazasulfuron, florasulam, fluazifop (-P-butyl), fluazolate, flucarbazone (-sodium), flufenacet, flumetsulam, flumiclorac (-pentyl), flumioxazin, flumipropyn, flumetsulam, fluometuron, fluorochloridone,  
15 fluoroglycofen (-ethyl), flupoxam, flupropacil, flurpysulfuron (-methyl, -sodium), flurenol (-butyl), fluridone, fluroxypyr (-butoxypropyl, -meptyl), flurprimidol, flurtamone, fluthiacet (-methyl), fluthiamide, fomesafen, foramsulfuron, glufosinate (-ammonium), glyphosate (-isopropylammonium), halosafen, haloxyfop (-ethoxyethyl, -P-methyl), hexazinone, imazamethabenz (-methyl), imazamethapyr,  
20 imazamox, imazapic, imazapyr, imazaquin, imazethapyr, imazosulfuron, iodosulfuron (-methyl, -sodium), ioxynil, isopropalin, isoproturon, isouron, isoxaben, isoxachlortole, isoxaflutole, isoxapyrifop, lactofen, lenacil, linuron, MCPA, mecoprop, mefenacet, mesotrione, metamitron, metazachlor, methabenzthiazuron, metobenzuron, metobromuron, (alpha-) metolachlor, metosulam, metoxuron,  
25 metribuzin, metsulfuron (-methyl), molinate, monolinuron, naproanilide, napropamide, neburon, nicosulfuron, norflurazon, orbencarb, oryzalin, oxadiargyl, oxadiazon, oxasulfuron, oxaziclomefone, oxyfluorfen, paraquat, pelargonic acid, pendimethalin, pendralin, pentoxazone, phenmedipham, picolinafen, piperophos, pretilachlor, primisulfuron (-methyl), profluazol, prometryn, propachlor, propanil,  
30 propaquizafop, propisochlor, propoxycarbazone (-sodium), propyzamide, prosulfocarb, prosulfuron, pyraflufen (-ethyl), pyrazogyl, pyrazolate, pyrazosulfuron

(-ethyl), pyrazoxyfen, pyribenzoxim, pyributicarb, pyridate, pyridatol, pyrifthalid, pyriminobac (-methyl), pyriothiobac (-sodium), quinchlorac, quinmerac, quinoclamine, quizalofop (-P-ethyl, -P-tefuryl), rimsulfuron, sethoxydim, simazine, simetryn, sulcotrione, sulfentrazone, sulfometuron (-methyl), sulfosate, sulfosulfuron, tebutam, tebuthiuron, tepraloxydim, terbuthylazine, terbutryn, thenylchlor, thiafluamide, thiazopyr, thidiazimin, thifensulfuron (-methyl), thiobencarb, tiocarbazil, tralkoxydim, triallate, triasulfuron, tribenuron (-methyl), triclopyr, tridiphane, trifluralin, trifloxysulfuron, triflusulfuron (-methyl), tritosulfuron.

10 Furthermore suitable for the mixtures are known safeners, for example:

AD-67, BAS-145138, benoxacor, cloquintocet (-mexyl), cyometrinil, 2,4-D, DKA-24, dichlormid, dymron, fenclorim, fenchlorazol (-ethyl), flurazole, fluxofenim, furilazole, isoxadifen (-ethyl), MCPA, mecoprop (-P), mefenpyr (-diethyl), MG-191, oxabetrinil, PPG-1292, R-29148.

A mixture with other known active compounds, such as fungicides, insecticides, acaricides, nematicides, bird repellents, plant nutrients and agents which improve soil structure, is also possible.

20

The active compounds can be used as such, in the form of their formulations or in the use forms prepared therefrom by further dilution, such as ready-to-use solutions, suspensions, emulsions, powders, pastes and granules. They are used in a customary manner, for example by watering, spraying, atomizing or broadcasting.

25

The active compounds according to the invention can be applied both before and after emergence of the plants. They can also be incorporated into the soil before sowing.

30

The amount of active compound used can vary within a relatively wide range. It depends essentially on the nature of the desired effect. In general, the amounts used

are between 1 g and 10 kg of active compound per hectare of soil surface, preferably between 5 g and 5 kg per ha.

5 The substances according to the invention have potent microbicidal activity and can be employed for controlling unwanted microorganisms, such as fungi and bacteria, in crop protection and in the protection of materials.

10 Fungicides can be employed in crop protection for controlling Plasmodiophoromycetes, Oomycetes, Chytridiomycetes, Zygomycetes, Ascomycetes, Basidiomycetes and Deuteromycetes.

Bactericides can be employed in crop protection for controlling Pseudomonadaceae, Rhizobiaceae, Enterobacteriaceae, Corynebacteriaceae and Streptomycetaceae.

15 Some pathogens causing fungal and bacterial diseases which come under the generic names listed above may be mentioned as examples, but not by way of limitation:

Xanthomonas species, such as, for example, Xanthomonas campestris pv. oryzae;

20 Pseudomonas species, such as, for example, Pseudomonas syringae pv. lachrymans;

Erwinia species, such as, for example, Erwinia amylovora;

25 Pythium species, such as, for example, Pythium ultimum;

Phytophthora species, such as, for example, Phytophthora infestans;

Pseudoperonospora species, such as, for example, Pseudoperonospora humuli or

30 Pseudoperonospora cubensis;



- Plasmopara species, such as, for example, *Plasmopara viticola*;
- Bremia species, such as, for example, *Bremia lactucae*;
- 5      *Peronospora* species, such as, for example, *Peronospora pisi* or *P. brassicae*;
- Erysiphe species, such as, for example, *Erysiphe graminis*;
- 10      *Sphaerotheca* species, such as, for example, *Sphaerotheca fuliginea*;
- Podosphaera* species, such as, for example, *Podosphaera leucotricha*;
- Venturia species, such as, for example, *Venturia inaequalis*;
- 15      *Pyrenophora* species, such as, for example, *Pyrenophora teres* or *P. graminea*
- (conidia form: *Drechslera*, syn: *Helminthosporium*);
- 20      *Cochliobolus* species, such as, for example, *Cochliobolus sativus*
- (conidia form: *Drechslera*, syn: *Helminthosporium*);
- Uromyces species, such as, for example, *Uromyces appendiculatus*;
- 25      *Puccinia* species, such as, for example, *Puccinia recondita*;
- Sclerotinia* species, such as, for example, *Sclerotinia sclerotiorum*;
- Tilletia* species, such as, for example, *Tilletia caries*;
- 30      *Ustilago* species, such as, for example, *Ustilago nuda* or *Ustilago avenae*;

Pellicularia species, such as, for example, Pellicularia sasakii;

Pyricularia species, such as, for example, Pyricularia oryzae;

5

Fusarium species, such as, for example, Fusarium culmorum;

Botrytis species, such as, for example, Botrytis cinerea;

10

Septoria species, such as, for example, Septoria nodorum;

Leptosphaeria species, such as, for example, Leptosphaeria nodorum;

Cercospora species, such as, for example, Cercospora canescens;

15

Alternaria species, such as, for example, Alternaria brassicae; and

Pseudocercospora species, such as, for example, Pseudocercospora herpotrichoides.

20

The active compounds according to the invention also have very good fortifying action in plants. Accordingly, they can be used for mobilizing the defences of the plant against attack by unwanted microorganisms.

25

In the present context, plant-fortifying (resistance-inducing) substances are to be understood as meaning those substances which are capable of stimulating the defence system of plants such that, when the treated plants are subsequently inoculated with unwanted microorganisms, they show substantial resistance against these microorganisms.

30

In the present case, undesirable microorganisms are to be understood as meaning phytopathogenic fungi, bacteria and viruses. Accordingly, the substances according to the invention can be used to protect plants for a certain period after the treatment against attack by the pathogens mentioned. The period for which protection is  
5 provided generally extends over 1 to 10 days, preferably 1 to 7 days, after the treatment of the plants with the active compounds.

The fact that the active compounds are well tolerated by plants at the concentrations required for controlling plant diseases permits the treatment of above-ground parts of  
10 plants, of propagation stock and seeds, and of the soil.

The active compounds according to the invention are also suitable for increasing the yield of crops. In addition, they show reduced toxicity and are well tolerated by  
15 plants.

At certain concentrations and application rates, the active compounds according to the invention can also be used as herbicides, for influencing plant growth and for controlling animal pests. If appropriate, they can also be used as intermediates and precursors for the synthesis of further active compounds.  
20

In the protection of materials, the compounds according to the invention can be employed for protecting industrial materials against infection with, and destruction by, undesired microorganisms.

25 Industrial materials in the present context are understood as meaning non-living materials which have been prepared for use in industry. For example, industrial materials which are intended to be protected by active compounds according to the invention from microbial change or destruction can be adhesives, sizes, paper and board, textiles, leather, wood, paints and plastic articles, cooling lubricants and other  
30 materials which can be infected with, or destroyed by, microorganisms. Parts of production plants, for example cooling-water circuits, which may be impaired by the

proliferation of microorganisms may also be mentioned within the scope of the materials to be protected. Industrial materials which may be mentioned within the scope of the present invention are preferably adhesives, sizes, paper and board, leather, wood, paints, cooling lubricants and heat-transfer liquids, particularly  
5 preferably wood.

Microorganisms capable of degrading or changing the industrial materials which may be mentioned are, for example, bacteria, fungi, yeasts, algae and slime organisms. The active compounds according to the invention preferably act against fungi, in  
10 particular moulds, wood-discolouring and wood-destroying fungi (Basidiomycetes), and against slime organisms and algae.

Microorganisms of the following genera may be mentioned as examples:

15 Alternaria, such as *Alternaria tenuis*,

*Aspergillus*, such as *Aspergillus niger*,

20 *Chaetomium*, such as *Chaetomium globosum*,

*Coniophora*, such as *Coniophora puetana*,

*Lentinus*, such as *Lentinus tigrinus*,

25 *Penicillium*, such as *Penicillium glaucum*,

*Polyporus*, such as *Polyporus versicolor*,

*Aureobasidium*, such as *Aureobasidium pullulans*,

30 *Sclerophoma*, such as *Sclerophoma pityophila*,

Trichoderma, such as *Trichoderma viride*,

*Escherichia*, such as *Escherichia coli*,

5      *Pseudomonas*, such as *Pseudomonas aeruginosa*, and

*Staphylococcus*, such as *Staphylococcus aureus*.

10      Depending on their particular physical and/or chemical properties, the active compounds can be converted into the customary formulations, such as solutions, emulsions, suspensions, powders, foams, pastes, granules, aerosols and microencapsulations in polymeric substances and in coating compositions for seeds, and ULV cool and warm fogging formulations.

15      These formulations are produced in a known manner, for example by mixing the active compounds with extenders, that is, liquid solvents, liquefied gases under pressure, and/or solid carriers, optionally with the use of surfactants, that is emulsifiers and/or dispersants, and/or foam formers. If the extender used is water, it is also possible to employ, for example, organic solvents as auxiliary solvents.

20      Essentially, suitable liquid solvents are: aromatics such as xylene, toluene or alkylnaphthalenes, chlorinated aromatics or chlorinated aliphatic hydrocarbons such as chlorobenzenes, chloroethylenes or methylene chloride, aliphatic hydrocarbons such as cyclohexane or paraffins, for example petroleum fractions, alcohols such as butanol or glycol and their ethers and esters, ketones such as acetone, methyl ethyl

25      ketone, methyl isobutyl ketone or cyclohexanone, strongly polar solvents such as dimethylformamide and dimethyl sulphoxide, or else water. Liquefied gaseous extenders or carriers are to be understood as meaning liquids which are gaseous at standard temperature and under atmospheric pressure, for example aerosol propellants such as halogenated hydrocarbons, or else butane, propane, nitrogen and

30      carbon dioxide. Suitable solid carriers are: for example ground natural minerals such as kaolins, clays, talc, chalk, quartz, attapulgite, montmorillonite or diatomaceous

earth, and ground synthetic minerals such as finely divided silica, alumina and silicates. Suitable solid carriers for granules are: for example crushed and fractionated natural rocks such as calcite, marble, pumice, sepiolite and dolomite, or else synthetic granules of inorganic and organic meals, and granules of organic material such as sawdust, coconut shells, maize cobs and tobacco stalks. Suitable emulsifiers and/or foam formers are: for example nonionic and anionic emulsifiers, such as polyoxyethylene fatty acid esters, polyoxyethylene fatty alcohol ethers, for example alkylaryl polyglycol ethers, alkylsulphonates, alkyl sulphates, arylsulphonates, or else protein hydrolysates. Suitable dispersants are: for example lignosulphite waste liquors and methylcellulose.

Tackifiers such as carboxymethylcellulose and natural and synthetic polymers in the form of powders, granules or latices, such as gum arabic, polyvinyl alcohol and polyvinyl acetate, or else natural phospholipids such as cephalins and lecithins and synthetic phospholipids can be used in the formulations. Other possible additives are mineral and vegetable oils.

It is possible to use colorants such as inorganic pigments, for example iron oxide, titanium oxide and Prussian Blue, and organic dyestuffs such as alizarin dyestuffs, azo dyestuffs and metal phthalocyanine dyestuffs, and trace nutrients such as salts of iron, manganese, boron, copper, cobalt, molybdenum and zinc.

The formulations generally comprise between 0.1 and 95% by weight of active compound, preferably between 0.5 and 90%.

The active compounds according to the invention can be used as such or in their formulations, also in a mixture with known fungicides, bactericides, acaricides, nematocides or insecticides, to broaden, for example, the activity spectrum or to prevent development of resistance. In many cases, synergistic effects are obtained, i.e. the activity of the mixture is greater than the activity of the individual components.

Examples of suitable mixing components are the following:

**Fungicides:**

2-phenylphenol; 8-hydroxyquinoline sulphate; acibenzolar-S-methyl; aldimorph;  
5 amidoflumet; ampropylfos; ampropylfos-potassium; andoprim; anilazine;  
azaconazole; azoxystrobin; benalaxyl; benodanil; benomyl; benthiavalicarb-  
isopropyl; benzamacril; benzamacril-isobutyl; bilanafos; binapacryl; biphenyl;  
bitertanol; blasticidin-S; bromuconazole; bupirimate; buthiobate; butylamine;  
10 calcium polysulphide; capsimycin; captafol; captan; carbendazim; carboxin;  
carpropamid; carvone; chinomethionat; chlobenthiazone; chlorfenazole; chloroneb;  
chlorothalonil; chlozolate; clozylacon; cyazofamid; cyflufenamid; cymoxanil;  
cyproconazole; cyprodinil; cyprofuram; Dagger G; debacarb; dichlofluanid; dichlone;  
dichlorophen; diclocymet; diclomezine; dicloran; diethofencarb; difenoconazole;  
diflumetorim; dimethirimol; dimethomorph; dimoxystrobin; diniconazole;  
15 diniconazole-M; dinocap; diphenylamine; dipyrithione; ditalimfos; dithianon;  
dodine; drazoxolon; edifenphos; epoxiconazole; ethaboxam; ethirimol; etridiazole;  
famoxadone; fenamidone; fenapanil; fenarimol; fenbuconazole; fenfuram;  
fenhexamid; fenitropan; fenoxanil; fenpiclonil; fenpropidin; fenpropimorph; ferbam;  
fluazinam; flubenzimine; fludioxonil; flumetover; flumorph; fluoromide;  
20 fluoxastrobin; fluquinconazole; flurprimidol; flusilazole; flusulfamide; flutolanil;  
flutriafol; folpet; fosetyl-Al; fosetyl-sodium; fuberidazole; furalaxyl; furametpyr;  
furcarbanil; furnecyclox; guazatine; hexachlorobenzene; hexaconazole; hymexazole;  
imazalil; imibenconazole; iminoctadine triacetate; iminoctadine tris(albesil);  
iodocarb; ipconazole; iprobenfos; iprodione; iprovalicarb; irumamycin;  
25 isoprothiolane; isovaledione; kasugamycin; kresoxim-methyl; mancozeb; maneb;  
meferimzone; mepanipyrim; mepronil; metalaxyl; metalaxyl-M; metconazole;  
methasulfocarb; methfuroxam; metiram; metominostrobin; metsulfovax;  
mildiomycin; myclobutanil; myclozolin; natamycin; nicobifen; nitrothal-isopropyl;  
noviflumuron; nuarimol; ofurace; orysastrobin; oxadixyl; oxolinic acid;  
30 oxpoconazole; oxycarboxin; oxyfenthiin; paclobutrazole; pefurazoate; penconazole;  
pencycuron; phosdiphen; phthalide; picoxystrobin; piperalin; polyoxins; polyoxorim;

probenazole; prochloraz; procymidone; propamocarb; propanosine-sodium;  
 propiconazole; propineb; proquinazid; prothioconazole; pyraclostrobin; pyrazophos;  
 pyrifenox; pyrimethanil; pyroquilon; pyroxyfur; pyrrolenitrine; quinconazole;  
 quinoxifen; quintozene; simeconazole; spiroxamine; sulphur; tebuconazole;  
 5 tecloftalam; tecnazene; tetcyclacis; tetraconazole; thiabendazole; thicyofen;  
 thifluzamide; thiophanate-methyl; thiram; tioxymid; tolclofos-methyl; tolylfluanid;  
 triadimefon; triadimenol; triazbutil; triazoxide; tricyclamide; tricyclazole;  
 tridemorph; trifloxystrobin; triflumizole; triforine; triticonazole; uniconazole;  
 validamycin A; vinclozolin; zineb; ziram; zoxamide; (2S)-N-[2-[4-[[3-(4-  
 10 chlorophenyl)-2-propynyl]oxy]-3-methoxyphenyl]ethyl]-3-methyl-2-  
 [(methylsulphonyl)amino]butanamide; 1-(1-naphthalenyl)-1H-pyrrole-2,5-dione;  
 2,3,5,6-tetrachloro-4-(methylsulphonyl)pyridine; 2-amino-4-methyl-N-phenyl-5-  
 thiazolecarboxamide; 2-chloro-N-(2,3-dihydro-1,1,3-trimethyl-1H-inden-4-yl)-3-  
 pyridinecarboxamide; 3,4,5-trichloro-2,6-pyridinedicarbonitrile; actinovate; cis-1-(4-  
 15 chlorophenyl)-2-(1H-1,2,4-triazol-1-yl)cycloheptanol; methyl 1-(2,3-dihydro-2,2-  
 dimethyl-1H-inden-1-yl)-1H-imidazole-5-carboxylate; monopotassium carbonate; N-  
 (6-methoxy-3-pyridinyl)-cyclopropanecarboxamide; N-butyl-8-(1,1-dimethylethyl)-1-  
 oxaspiro[4.5]decane-3-amine; sodium tetrathiocarbonate;  
 and copper salts and preparations, such as Bordeaux mixture; copper hydroxide;  
 20 copper naphthenate; copper oxychloride; copper sulphate; cufraneb; cuprous oxide;  
 mancopper; oxine-copper.

#### **Bactericides:**

bronopol, dichlorophen, nitrapyrin, nickel dimethyldithiocarbamate, kasugamycin,  
 25 octhilinone, furancarboxylic acid, oxytetracyclin, probenazole, streptomycin, teclof-  
 talam, copper sulphate and other copper preparations.

#### **Insecticides / acaricides / nematocides:**

abamectin, ABG-9008, acephate, acequinocyl, acetamiprid, acetoprole, acrinathrin,  
 30 AKD-1022, AKD-3059, AKD-3088, alanycarb, aldicarb, aldoxycarb, allethrin,  
 allethrin 1R-isomers, alpha-cypermethrin (alphamethrin), amidoflumet, aminocarb,



amitraz, avermectin, AZ-60541, azadirachtin, azamethiphos, azinphos-methyl, azinphos-ethyl, azocyclotin,

5 Bacillus popilliae, Bacillus sphaericus, Bacillus subtilis, Bacillus thuringiensis, Bacillus thuringiensis strain EG-2348, Bacillus thuringiensis strain GC-91, Bacillus thuringiensis strain NCTC-11821, baculoviruses, Beauveria bassiana, Beauveria tenella, bendiocarb, benfuracarb, bensultap, benzoximate, beta-cyfluthrin, beta-cypermethrin, bifenazate, bifenthrin, binapacryl, bioallethrin, bioallethrin-S-cyclopentyl-isomer, bioethanomethrin, biopermethrin, bioresmethrin, bistrifluron, BPMC, brofenprox, 10 bromophos-ethyl, bromopropylate, bromfenvinfos (-methyl), BTG-504, BTG-505, bufencarb, buprofezin, butathiofos, butocarboxim, butoxycarboxim, butylpyridaben,

cadusafos, camphechlor, carbaryl, carbofuran, carbophenothion, carbosulfan, cartap, 15 CGA-50439, chinomethionat, chlordane, chlordimeform, chloethocarb, chlorethoxyfos, chlorfenapyr, chlorfenvinphos, chlorfluazuron, chlormephos, chlorobenzilate, chloropicrin, chlorproxyfen, chlorpyrifos-methyl, chlorpyrifos (-ethyl), chlovaporthrin, chromafenozide, cis-cypermethrin, cis-resmethrin, cis-permethrin, clocythrin, cloethocarb, clofentezine, clothianidin, clothiazoben, codlemone, coumaphos, cyanofenphos, 20 cyanophos, cycloprene, cycloprothrin, Cydia pomonella, cyfluthrin, cyhalothrin, cyhexatin, cypermethrin, cyphenothrin (1R-trans-isomer), cyromazine,

DDT, deltamethrin, demeton-S-methyl, demeton-S-methylsulphone, diafenthiuron, dialifos, diazinon, dichlofenthion, dichlorvos, dicofol, dicrotophos, dicyclanil, diflu- 25 benzuron, dimethoate, dimethylvinphos, dinobuton, dinocap, dinotefuran, diofenolan, disulfoton, docusat-sodium, dofenapyn, DOWCO-439,

eflusalate, emamectin, emamectin-benzoate, empenthrin (1R-isomer), endosulfan, Entomophthora spp., EPN, esfenvalerate, ethiofencarb, ethiprole, ethion, ethoprophos, 30 etofenprox, etoxazole, etrimfos,

5 famphur, fenamiphos, fenazaquin, fenbutatin oxide, fenfluthrin, fenitrothion, fenobu-  
carb, fenothiocarb, fenoxacrim, fenoxycarb, fenpropathrin, fenpyrad, fenpyrithrin,  
fenpyroximate, fensulfothion, fenthion, fentrifanil, fenvalerate, fipronil, flonicamid,  
flucacrypyrim, fluazuron, flubenzimine, flubrocycythrinate, flucycloxuron, flucythrinate,  
10 flufenerim, flufenoxuron, flufenprox, flumethrin, flupyrazofos, flutenzin (flufenzine),  
fluvalinate, fonofos, formetanate, formothion, fosmethilan, fosthiazate, fubfenprox  
(fluproxyfen), furathiocarb,  
  
10 gamma-HCH, gossypure, grandlure, granulosis viruses,  
  
halofenprox, halofenozide, HCH, HCN-801, heptenophos, hexaflumuron, hexy-  
thiazox, hydramethylnone, hydroprene,  
  
15 IKA-2002, imidacloprid, imiprothrin, indoxacarb, iodofenphos, iprobenfos, isazofos,  
isofenphos, isoprocab, isoxathion, ivermectin,  
  
japonilure,  
  
20 kadethrin, nuclear polyhedrosis viruses, kinoprene,  
  
lambda-cyhalothrin, lindane, lufenuron,  
  
25 malathion, mecarbam, mesulfenfos, metaldehyde, metam-sodium, methacrifos,  
methamidophos, Metharhizium anisopliae, Metharhizium flavoviride, methidathion,  
methiocarb, methomyl, methoprene, methoxychlor, methoxyfenozide, metolcarb,  
metoxadiazone, mevinphos, milbemectin, milbemycin, MKI-245, MON-45700,  
monocrotophos, moxidectin, MTI-800,  
  
30 naled, NC-104, NC-170, NC-184, NC-194, NC-196, niclosamide, nicotine, niten-  
pyram, nithiazine, NNI-0001, NNI-0101, NNI-0250, NNI-9768, novaluron, novi-  
flumuron,

OK-5101, OK-5201, OK-9601, OK-9602, OK-9701, OK-9802, omethoate, oxamyl, oxydemeton-methyl,

5 Paecilomyces fumosoroseus, parathion-methyl, parathion (-ethyl), permethrin (cis-, trans-), petroleum, PH-6045, phenothrin (1R-trans isomer), phenthoate, phorate, phosalone, phosmet, phosphamidon, phosphocarb, phoxim, piperonyl butoxide, pirimicarb, pirimiphos-methyl, pirimiphos-ethyl, prallethrin, profenofos, promecarb, propaphos, propargite, propetamphos, propoxur, prothiofos, prothoate, protrifenbute, pymetrozine, pyraclofos, pyresmethrin, pyrethrum, pyridaben, pyridalyl, pyridaphen-  
10 thion, pyridathion, pyrimidifen, pyriproxyfen,

quinalphos,

15 resmethrin, RH-5849, ribavirin, RU-12457, RU-15525,

S-421, S-1833, salithion, sebufos, SI-0009, silafluofen, spinosad, spirodiclofen, spiromesifen, sulfluramid, sulfotep, sulprofos, SZI-121,

20 tau-fluvalinate, tebufenozide, tebufenpyrad, tebupirimfos, teflubenzuron, tefluthrin, temephos, temivinphos, terbam, terbufos, tetrachlorvinphos, tetradifon, tetramethrin, tetramethrin (1R-isomer), tetrasul, theta-cypermethrin, thiacloprid, thiamethoxam, thiapronil, thiatriphos, thiocyclam hydrogenoxalate, thiodicarb, thiofanox, thiometon, thiosultap-sodium, thuringiensin, tolfenpyrad, tralocythrin, tralomethrin, transfluthrin, triarathene, triazamate, triazophos, triazuron, trichlophenidine, trichlor-  
25 fon, triflumuron, trimethacarb,

vamidothion, vaniliprole, verbutin, Verticillium lecanii,

30 WL-108477, WL-40027,

YI-5201, YI-5301, YI-5302,

XMC, xylylcarb,

ZA-3274, zeta-cypermethrin, zolaprofos, ZXI-8901,

5

the compound 3-methylphenyl propylcarbamate (tsumacide Z),  
the compound 3-(5-chloro-3-pyridinyl)-8-(2,2,2-trifluoroethyl)-8-azabicyclo[3.2.1]-  
octane-3-carbonitrile (CAS-Reg. No. 185982-80-3) and the corresponding 3-endo-  
isomer (CAS-Reg. No. 185984-60-5) (cf. WO-96/37494, WO-98/25923),

10

and preparations which comprise insecticidally active plant extracts, nematodes,  
fungi or viruses.

15

A mixture with other known active compounds, such as herbicides, or with fertilizers  
and growth regulators, is also possible.

20

In addition, the compounds of the formula (I) according to the invention also have  
very good antimycotic activity. They have a very broad antimycotic activity spectrum  
in particular against dermatophytes and yeasts, moulds and diphasic fungi (for  
example against *Candida* species, such as *Candida albicans*, *Candida glabrata*), and  
*Epidermophyton floccosum*, *Aspergillus* species, such as *Aspergillus niger* and  
*Aspergillus fumigatus*, *Trichophyton* species, such as *Trichophyton mentagrophytes*,

25

*Microsporon* species such as *Microsporon canis* and *audouinii*. The list of these fungi  
by no means limits the mycotic spectrum covered, but is only for illustration.

30

The active compounds can be used as such, in the form of their formulations or the  
use forms prepared therefrom, such as ready-to-use solutions, suspensions, wettable  
powders, pastes, soluble powders, dusts and granules. Application is carried out in a  
customary manner, for example by watering, spraying, atomizing, broadcasting,  
dusting, foaming, spreading, etc. It is furthermore possible to apply the active

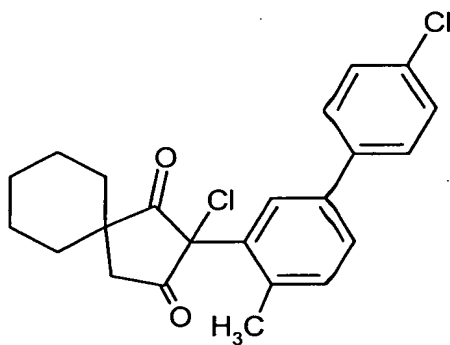
compounds by the ultra-low-volume method, or to inject the active compound preparation or the active compound itself into the soil. It is also possible to treat the seeds of the plants.

5      When using the active compounds according to the invention as fungicides, the application rates can be varied within a relatively wide range, depending on the kind of application. For the treatment of parts of plants, the active compound application rates are generally between 0.1 and 10,000 g/ha, preferably between 10 and 1000 g/ha. For seed dressing, the active compound application rates are generally  
10      between 0.001 and 50 g per kilogram of seed, preferably between 0.01 and 10 g per kilogram of seed. For the treatment of the soil, the active compound application rates are generally between 0.1 and 10,000 g/ha, preferably between 1 and 5000 g/ha.

15      The preparation and the use of the active compounds according to the invention is illustrated by the examples below.

**Preparation examples**

**Example I-1-1**



5

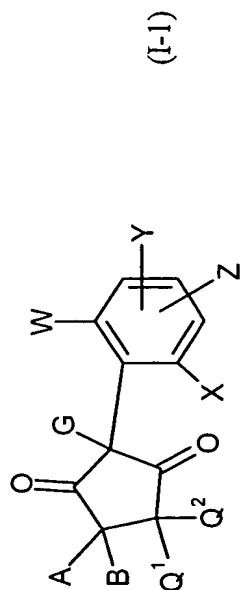
0.16 ml of sulphuryl chloride in 0.5 ml of anhydrous chloroform is added to 0.73 g of the compound of Preparation Example I-7-a-2 from EP-A 1 066 258 in 20 ml of anhydrous chloroform. The mixture is stirred for 20 minutes.

10

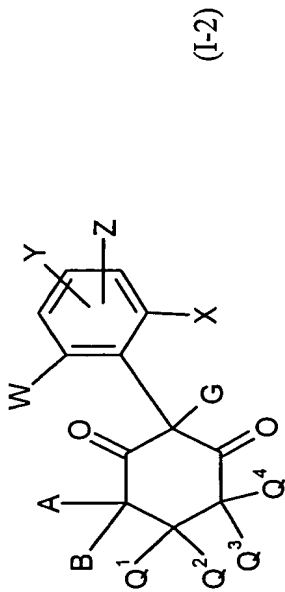
The reaction solution is washed with sodium bicarbonate solution and dried, and the solvent is then distilled off. The crude product is titrated with cyclohexane/ethyl acetate and crystallizes out.

Yield: 0.59 g (74% of theory), m.p. 135-136°C

The following compounds of the formula (I-1) and the formula (I-2) are obtained analogously to Example (I-1-a-1) and in accordance with the general statements on the preparation



Ex. No.	W	X	Y	Z	A	B	Q <sup>1</sup>	Q <sup>2</sup>	G	m.p. °C
I-1-2	CH <sub>3</sub>	H	5-Br	H	-(CH <sub>2</sub> ) <sub>5</sub> -		H	H	Cl	150-151
I-1-3	CH <sub>3</sub>	H	5-(4-Cl-C <sub>6</sub> H <sub>4</sub> )	H	-(CH <sub>2</sub> ) <sub>4</sub> -		H	H	Cl	188-189
I-1-4	CH <sub>3</sub>	H	5-(4-Cl-C <sub>6</sub> H <sub>4</sub> )	H	-(CH <sub>2</sub> ) <sub>6</sub> -		H	H	Cl	159-161
I-1-5	CH <sub>3</sub>	H	5-(4-Cl-C <sub>6</sub> H <sub>4</sub> )	H	CH <sub>3</sub>	CH <sub>3</sub>	H	H	Cl	86-88
I-1-6	CH <sub>3</sub>	H	5-(3,5-Cl <sub>2</sub> -C <sub>6</sub> H <sub>3</sub> )	H	-(CH <sub>2</sub> ) <sub>5</sub> -		H	H	Cl	161-162
I-1-7	CH <sub>3</sub>	H	5-(3-Cl-C <sub>6</sub> H <sub>4</sub> )	H	-(CH <sub>2</sub> ) <sub>5</sub> -		H	H	Cl	125-126
I-1-8	Cl	CH <sub>3</sub>	4-CH <sub>3</sub>	H	-(CH <sub>2</sub> ) <sub>5</sub> -		H	H	Cl	Oil



Ex. No.	W	X	Y	Z	A	B	Q <sup>1</sup>	Q <sup>2</sup>	Q <sup>3</sup>	Q <sup>4</sup>	G	m.p. °C
I-2-1	Cl	H	5-(4-Cl-C <sub>6</sub> H <sub>4</sub> )	H	H	H	CH <sub>3</sub>	CH <sub>3</sub>	H	H	Cl	161-162
I-2-2	CH <sub>3</sub>	H	5-(4-Cl-C <sub>6</sub> H <sub>4</sub> )	H	H	H	-(CH <sub>2</sub> ) <sub>4</sub> -	-(CH <sub>2</sub> ) <sub>4</sub> -	H	H	Cl	144-145
I-2-3	CH <sub>3</sub>	H	5-(4-Cl-C <sub>6</sub> H <sub>4</sub> )	H	H	H	CH <sub>3</sub>	CH <sub>3</sub>	H	H	Cl	186-188
I-2-4	Cl	H	5-Br	H	H	H	-(CH <sub>2</sub> ) <sub>4</sub> -	-(CH <sub>2</sub> ) <sub>4</sub> -	H	H	Cl	141-143
I-2-5	Cl	H	5-(4-Cl-C <sub>6</sub> H <sub>4</sub> )	H	H	H	-(CH <sub>2</sub> ) <sub>4</sub> -	-(CH <sub>2</sub> ) <sub>4</sub> -	H	H	Cl	138-140
I-2-6	Cl	H	5-Br	H	H	H	i-C <sub>3</sub> H <sub>7</sub>	H	H	H	Cl	178-179
I-2-7	Cl	H	5-CF <sub>3</sub>	H	H	H	-(CH <sub>2</sub> ) <sub>4</sub> -	-(CH <sub>2</sub> ) <sub>4</sub> -	H	H	Cl	112-116
I-2-8	CH <sub>3</sub>	H	5-(4-Cl-C <sub>6</sub> H <sub>4</sub> )	H	H	H	C <sub>6</sub> H <sub>13</sub>	H	H	H	Cl	112
I-2-9	CH <sub>3</sub>	H	5-C <sub>2</sub> H <sub>5</sub>	H	H	H	-(CH <sub>2</sub> ) <sub>4</sub> -	-(CH <sub>2</sub> ) <sub>4</sub> -	H	H	Cl	Oil
I-2-10	CH <sub>3</sub>	H	5-(2,5-F <sub>2</sub> C <sub>6</sub> H <sub>3</sub> )	H	H	H	-(CH <sub>2</sub> ) <sub>4</sub> -	-(CH <sub>2</sub> ) <sub>4</sub> -	H	H	Cl	129
I-2-11	CH <sub>3</sub>	H	5-i-C <sub>4</sub> H <sub>9</sub>	H	H	H	-(CH <sub>2</sub> ) <sub>4</sub> -	-(CH <sub>2</sub> ) <sub>4</sub> -	H	H	Cl	Oil



Ex. No.	W	X	Y	Z	A	B	Q1	Q2	Q3	Q4	G	m.p. °C
I-2-12	CH <sub>3</sub>	H	5-i-C <sub>4</sub> H <sub>9</sub>	H	H	H	C <sub>2</sub> H <sub>5</sub>	CH <sub>3</sub>	H	H	Cl	Oil
I-2-13	CH <sub>3</sub>	H	5-n-C <sub>3</sub> H <sub>7</sub>	H	H	H	-(CH <sub>2</sub> ) <sub>4</sub> -		H	H	Cl	Oil
I-2-14	Cl	H	3-Cl	H	H	H	-(CH <sub>2</sub> ) <sub>4</sub> -		H	H	Cl	Oil
I-2-15	CH <sub>3</sub>	H	5-CHCH <sub>3</sub> i-C <sub>4</sub> H <sub>9</sub>	H	H	H	-(CH <sub>2</sub> ) <sub>4</sub> -		H	H	Cl	Resin
I-2-16	CH <sub>3</sub>	H	5-(4-Cl-C <sub>6</sub> H <sub>4</sub> )	H	H	H	-(CH <sub>2</sub> ) <sub>5</sub> -		H	H	Cl	187-188
I-1-17	CH <sub>3</sub>	H	5-(3-Cl-C <sub>6</sub> H <sub>4</sub> )	H	H	H	CH <sub>3</sub>	CH <sub>3</sub>	H	H	Cl	126-129

**Example A**

Meloidogyne test

- 5 Solvent: 7 parts by weight of dimethylformamide  
Emulsifier: 2 parts by weight of alkylaryl polyglycol ether

To produce a suitable preparation of active compound, 1 part by weight of active compound is mixed with the stated amounts of solvent and emulsifier, and the concentrate is diluted with water to the desired concentration.

10

Containers are filled with sand, solution of active compound, Meloidogyne incognita egg/larvae suspension and lettuce seeds. The lettuce seeds germinate and the plants develop. On the roots, galls are formed.

- 15 After the desired period of time, the nematocidal action is determined in % by the gall formation. 100% means that no galls have been formed; 0% means that the number of galls on the treated plants corresponds to that of the untreated control.

- 20 In this test, for example, the following compounds of the Preparation Examples show good activity:

Table A  
Plant-damaging nematodes  
Meloidogyne test

Active compounds	Concentration of active compounds in ppm	Effect in % after 14 <sup>d</sup>
Ex. I-2-6	20	80
Ex. I-2-1	20	90

**Example B**

Myzus test

- 5      Solvent:                      7 parts by weight of dimethylformamide  
      Emulsifier:                2 parts by weight of alkylaryl polyglycol ether

To produce a suitable preparation of active compound, 1 part by weight of active compound is mixed with the stated amounts of solvent and emulsifier, and the concentrate is diluted with emulsifier-containing water to the desired concentration.

10

Cabbage leaves (*Brassica oleracea*) which are heavily infested by the peach aphid (*Myzus persicae*) are treated by being dipped into the preparation of active compound of the desired concentration.

- 15      After the desired period of time, the kill in % is determined. 100% means that all aphids have been killed; 0% means that none of the aphids have been killed.

In this test, for example, the following compounds of the Preparation Examples show good activity:

Table B

Plant-damaging insects

Myzus test

Active compounds	Concentration of active compounds in ppm	Kill rate in % after 6 <sup>d</sup>
Ex. I-1-1	500	80

**Example C**

Phaedon larvae test

- Solvent: 7 parts by weight of dimethylformamide  
5 Emulsifier: 2 parts by weight of alkylaryl polyglycol ether

To produce a suitable preparation of active compound, 1 part by weight of active compound is mixed with the stated amounts of solvent and emulsifier, and the concentrate is diluted with emulsifier-containing water to the desired concentration.

10

Cabbage leaves (*Brassica oleracea*) are treated by being dipped into the preparation of active compound of the desired concentration and are populated with larvae of the mustard beetle (*Phaedon cochleariae*) while the leaves are still moist.

- 15 After the desired period of time, the kill in % is determined. 100% means that all beetle larvae have been killed; 0% means that none of the beetle larvae have been killed.

- 20 In this test, for example, the following compounds of the Preparation Examples show good activity:

Table C

Plant-damaging insects

**Phaedon larvae test**

Active compounds	Concentration of active compounds in ppm	Kill rate in % after 7 <sup>d</sup>
Ex. I-2-5	500	100
Ex. I-1-1	500	100
Ex. I-2-2	500	100
Ex. I-2-1	500	100
Ex. I-2-3	500	100

**Example D**

Spodoptera frugiperda test

Solvent: 7 parts by weight of dimethylformamide

5 Emulsifier: 2 parts by weight of alkylaryl polyglycol ether

To produce a suitable preparation of active compound, 1 part by weight of active compound is mixed with the stated amounts of solvent and emulsifier, and the concentrate is diluted with emulsifier-containing water to the desired concentration.

10

Cabbage leaves (*Brassica oleracea*) are treated by being dipped into the preparation of active compound of the desired concentration and are populated with caterpillars of the armyworm (*Spodoptera frugiperda*) while the leaves are still moist.

15

After the desired period of time, the kill in % is determined. 100% means that all caterpillars have been killed; 0% means that none of the caterpillars have been killed.

In this test, for example, the following compounds of the Preparation Examples show good activity:



Table D  
Plant-damaging insects  
**Spodoptera frugiperda test**

Active compounds	Concentration of active compounds in ppm	Kill rate in % after 7 <sup>d</sup>
Ex. I-2-5	500	100
Ex. I-2-2	500	100
Ex. I-2-1	500	100
Ex. I-2-3	500	100

**Example E**

Tetranychus test (OP-resistant/dip treatment)

- 5      Solvent:                      7 parts by weight of dimethylformamide  
      Emulsifier:                2 parts by weight of alkylaryl polyglycol ether

To produce a suitable preparation of active compound, 1 part by weight of active compound is mixed with the stated amounts of solvent and emulsifier, and the concentrate is diluted with emulsifier-containing water to the desired concentration.

10

Bean plants (*Phaseolus vulgaris*) which are heavily infested by all stages of the greenhouse rat spider mite (*Tetranychus urticae*) are dipped into a preparation of active compound of the desired concentration.

15

After the desired period of time, the effect in % is determined. 100% means that all spider mites have been killed; 0% means that none of the spider mites have been killed.

20

In this test, for example, the following compounds of the Preparation Examples show good activity:

Table E

Plant-damaging mites

**Tetranychus test (OP-resistant/dip treatment)**

Active compounds	Concentration of active compounds in ppm	Kill rate in % after 7 <sup>d</sup>
Ex. I-2-5	100	98
Ex. I-2-4	100	80
Ex. I-1-1	100	100
Ex. I-2-2	100	98
Ex. I-2-1	100	100
Ex. I-2-3	100	100

**Example F**

Plasmopara test (grapevine)/protective

Solvents:      24.5 parts by weight of acetone  
5                   24.5 parts by weight of dimethylacetamide

Emulsifier:    1.0 part by weight of alkylaryl polyglycol ether

10      To produce a suitable preparation of active compound, 1 part by weight of active compound is mixed with the stated amounts of solvent and emulsifier, and the concentrate is diluted with water to the desired concentration.

15      To test for protective activity, young plants are sprayed with the preparation of active compound at the stated application rate. After the spray coating has dried on, the plants are inoculated with an aqueous spore suspension of *Plasmopara viticola* and then remain in an incubation cabin at about 20°C and 100% relative atmospheric humidity for 1 day. The plants are then placed in a greenhouse at about 21°C and about 90% atmospheric humidity for 4 days. The plants are then moistened and placed in an incubation cabin for 1 day.

20

Evaluation is carried out 6 days after the inoculation. 0% means an efficacy which corresponds to that of the control, whereas an efficacy of 100% means that no infection is observed.

Table F

Plasmopara test (grapevine)/protective

Active compound	Application rate of active compound in g/ha	% efficacy
Ex. I-1-1	100	100

**Example G**

Sphaerotheca test (cucumber)/protective

5 Solvents: 24.5 parts by weight of acetone  
24.5 parts by weight of dimethylacetamide  
Emulsifier: 1.0 part by weight of alkylaryl polyglycol ether

10 To produce a suitable preparation of active compound, 1 part by weight of active compound is mixed with the stated amounts of solvent and emulsifier, and the concentrate is diluted with water to the desired concentration.

To test for protective activity, young plants are sprayed with the preparation of active compound at the stated application rate. After the spray coating has dried on, the plants are inoculated with an aqueous spore suspension of *Sphaerotheca fuliginea*  
15 The plants are then placed in a greenhouse at about 23°C and a relative atmospheric humidity of about 70%.

Evaluation is carried out 7 days after the inoculation. 0% means an efficacy which corresponds to that of the control, whereas an efficacy of 100% means that no  
20 infection is observed.

Table G

Sphaerotheca test (cucumber)/protective

Active compound	Application rate of active compound in g/ha	% efficacy
Ex. I-2-1	100	97

**Example H**

Venturia test (apple)/protective

Solvents: 24.5 parts by weight of acetone

5 24.5 parts by weight of dimethylacetamide

Emulsifier: 1.0 part by weight of alkylaryl polyglycol ether

10 To produce a suitable preparation of active compound, 1 part by weight of active compound is mixed with the stated amounts of solvent and emulsifier, and the concentrate is diluted with water to the desired concentration.

15 To test for protective activity, young plants are sprayed with the preparation of active compound at the stated application rate. After the spray coating has dried on, the plants are inoculated with an aqueous conidia suspension of the apple scab pathogen *Venturia inaequalis* and then remain in an incubation cabin at about 20°C and 100% relative atmospheric humidity for 1 day.

20 The plants are then placed in a greenhouse at about 21°C and a relative atmospheric humidity of about 90%.

Evaluation is carried out 10 days after the inoculation. 0% means an efficacy which corresponds to that of the control, whereas an efficacy of 100% means that no infection is observed.



Table H

Venturia test (apple)/protective

Active compound	Application rate of active compound in g/ha	% efficacy
Ex. I-1-1	100	100
Ex. I-2-1	100	73
Ex. I-2-3	100	86

**Example I**

Botrytis test (bean)/protective

5 Solvents: 24.5 parts by weight of acetone  
24.5 parts by weight of dimethylacetamide  
Emulsifier: 1.0 part by weight of alkylaryl polyglycol ether

10 To produce a suitable preparation of active compound, 1 part by weight of active compound is mixed with the stated amounts of solvent and emulsifier, and the concentrate is diluted with water to the desired concentration.

15 To test for protective activity, young plants are sprayed with the preparation of active compound at the stated application rate. After the spray coating has dried on, 2 small pieces of agar colonized by Botrytis cinerea are placed on each leaf. The inoculated plants are placed in a dark chamber at about 20°C and 100% relative atmospheric humidity.

20 2 days after the inoculation, the size of the infected areas on the leaves is evaluated. 0% means an efficacy which corresponds to that of the control, whereas an efficacy of 100% means that no infection is observed.

Table I

Botrytis test (bean)/protective

Active compound	Application rate of active compound in g/ha	% efficacy
Ex. I-1-1	100	96

**Example J**

Phytophthora test (tomato)/protective

Solvent: 49 parts by weight of N,N-dimethylformamide

5 Emulsifier: 1 part by weight of alkylaryl polyglycol ether

To produce a suitable preparation of active compound, 1 part by weight of active compound is mixed with the stated amounts of solvent and emulsifier, and the concentrate is diluted with water to the desired concentration.

10

To test for protective activity, young tomato plants are sprayed with the preparation of active compound at the stated application rate. 1 day after the treatment, the plants are inoculated with a spore suspension of *Phytophthora infestans* and then remain at 100% relative humidity and 20°C for 24 h. The plants are then placed in a climatized chamber at about 96% relative atmospheric humidity and a temperature of about 20°C.

15

Evaluation was carried out 7 days after the inoculation. 0% means an efficacy which corresponds to that of the control, whereas an efficacy of 100% means that no infection is observed.

20

Table J

Phytophthora test (tomato)/protective

Active compound	Application rate of active compound in g/ha	Efficacy in %
Ex. I-2-1	750	89
Ex. I-1-3	750	80
Ex. I-1-4	750	90

**Example K**

Post-emergence test

- 5 Solvent: 5 parts by weight of acetone  
Emulsifier: 1 part by weight of alkylaryl polyglycol ether

10 To produce a suitable preparation of active compound, 1 part by weight of active compound is mixed with the stated amount of solvent, the stated amount of emulsifier is added and the concentrate is diluted with water to the desired concentration.

15 Test plants of a height of 5-15 cm are sprayed with the preparation of active compounds such that the particular amounts of active compound desired are applied per unit area. The concentration of spray liquor is chosen such that the particular amounts of active compound desired are applied in 1000 l of water/ha.

After three weeks, the degree of damage to the plants is rated in % damage in comparison to the development of the untreated control.

20 The figures denote:

0% = no effect (like untreated control)  
100% = total destruction

**Example L**

Pre-emergence test

- 5 Solvent: 5 parts by weight of acetone  
Emulsifier: 1 part by weight of alkylaryl polyglycol ether

10 To produce a suitable preparation of active compound, 1 part by weight of active compound is mixed with the stated amount of solvent, the stated amount of emulsifier is added and the concentrate is diluted with water to the desired concentration.

15 Seeds of the test plants are sown in normal soil. After about 24 hours, the soil is sprayed with the preparation of active compounds such that the particular amounts of active compound desired are applied per unit area. The concentration of the spray liquor is chosen such that the particular amounts of active compound desired are applied in 1000 l of water/ha.

20 After three weeks, the degree of damage to the plants is rated in % damage in comparison to the development of the untreated control.

The figures denote:

0% = no effect (like untreated control)  
100% = total destruction

pre-emergence	g of ai/ha	Sugar beet	Alopecurus	Echinochloa	Setaria
Ex. I-1-1	250	0	-	100	90
Ex. I-2-2	250	0	90	95	90
Ex. I-2-1	250	0	70	90	80
Ex. I-2-3	250	0	80	80	90



**Example M**

Critical concentration test/soil insects – treatment of transgenic plants

5      Test insect:                      *Diabrotica balteata* – larvae in soil

Solvent:                              7 parts by weight of acetone

Emulsifier:                        1 part by weight of alkylaryl polyglycol ether

10      To produce a suitable preparation of active compound, 1 part by weight of active compound is mixed with the stated amount of solvent, the stated amount of emulsifier is added and the concentrate is diluted with water to the desired concentration.

15      The preparation of active compound is poured onto the soil. The concentration of active compound in the preparation is virtually immaterial, only the amount by weight of active compound per volume unit of soil, which is stated in ppm (mg/l), matters. The soil is filled into 0.25 l pots, and these are allowed to stand at 20°C.

20      Immediately after the preparation, 5 pregerminated maize corns of the cultivar YIELD GUARD (trade mark of Monsanto Comp., USA) are placed into each pot. After 2 days, the corresponding test insects are placed into the treated soil. After a further 7 days, the efficacy of the active compound is determined by counting the number of maize plants that have emerged (1 plant = 20% activity).

**Example N**

Heliothis virescens test – treatment of transgenic plants

- 5      Solvent:                      7 parts by weight of acetone  
       Emulsifier:                1 part by weight of alkylaryl polyglycol ether

10      To produce a suitable preparation of active compound, 1 part by weight of active compound is mixed with the stated amount of solvent and the stated amount of emulsifier, and the concentrate is diluted with water to the desired concentration.

15      Soybean shoots (Glycine max) of the cultivar Roundup Ready (trade mark of Monsanto Comp. USA) are treated by being dipped into the preparation of active compound of the desired concentration and are populated with the tobacco bat worm caterpillar Heliothis virescens while the leaves are still moist.

After the desired period of time, the kill of the insects is determined.